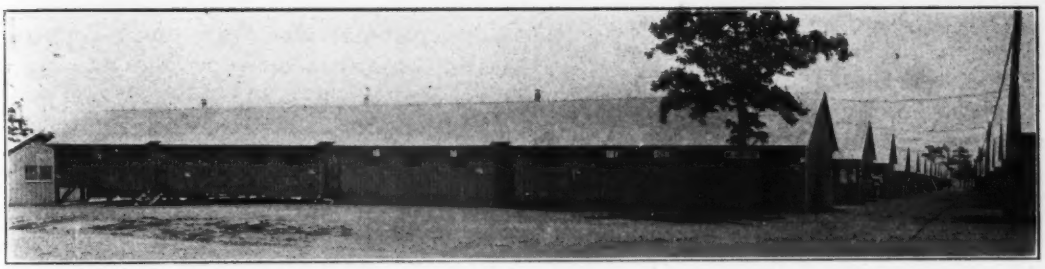
THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. NOVEMBER, 1917 1123 Broadway, New York



TYPICAL BARRACKS IN OFFICERS' RESERVE TRAINING CAMP.

Ventilation of Army Barracks.

A Discussion of the Types Adopted, Together with Suggested Specifications for "Squad Houses."

By W. J. MAUER,
Engineer, Chicago Commission on Ventilation.

(From a paper read before the Engineering Section of the American Public Health Association, in Washington, D. C., October 18, 1917.)

Ventilation is a definite problem, although varying under different conditions, and each case has its definite solution. The haphazard method of opening a window here and there is not the solution. The proper arangement of supply and exhaust; the proper allowance of window space for air space; window height for room height; space for occupant, and air distribution and velocity is as definite a problem for the heating and ventilating engineer as the proper proportioning of flange areas and web area in a plate girder is to the structural engineer, or intensity of light, size of opening, and time of exposure is to the photographer.

That some of the vital points on proper housing have in the past been overlooked in the design of barracks is evident from the number of cases of disease that existed in camps.

Young men from all walks of life are now concentrating at various training points and as many as 200 are being housed in the same building. If any one of these has measles, mumps, meningitis, pneumonia or other diseases, the entire number in that building may be exposed to the infection, and this is especially dangerous when the air supply is inadequate and other points of sanitation are disregarded.

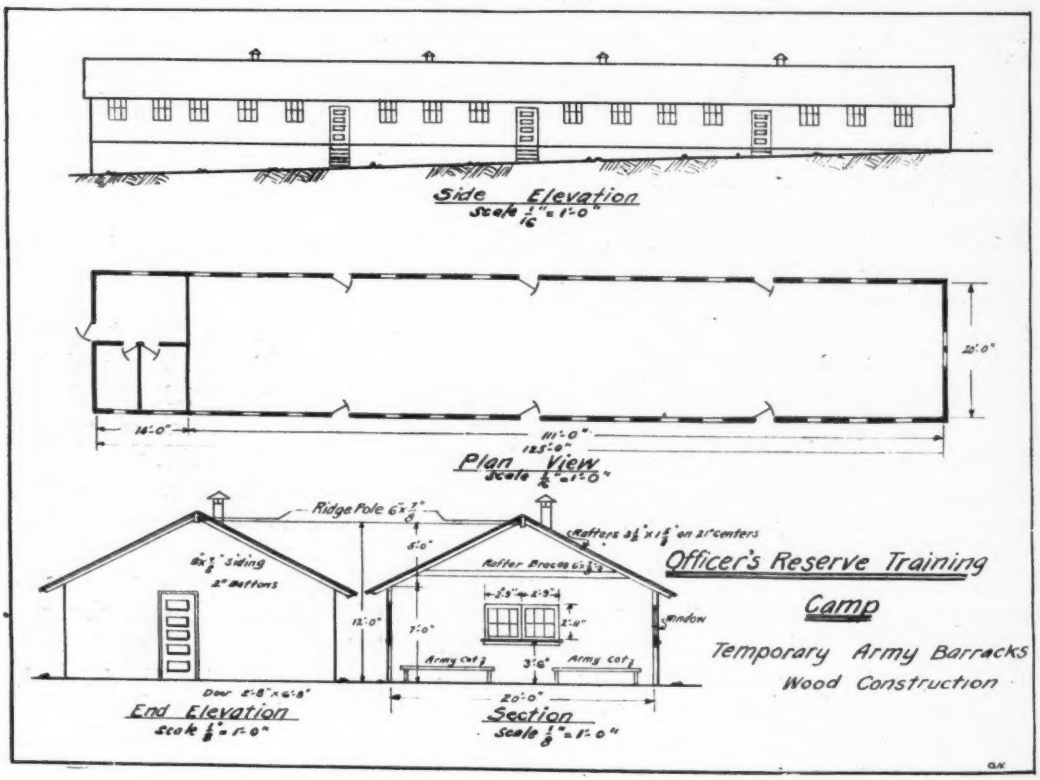
In a recent article by Frederic J. Haskin, special correspondent for *The Chicago Daily News,* the conditions of the French army in the present war were given. He states that France has dis-

charged 200,000 soldiers on account of tuberculosis since the beginning of the war, and that the spread of the disease in the British army has reached such alarming proportions that the civilian population has organized to combat the situation. This comes at a time when France is making a struggle for existence. The fault is not with the French army but with the French people, and when I say this I mean the French medical and engineering societies. "Before the war the death rate from tuberculosis was nearly three per thousand of population, in the cities the percentage running much higher." The cause was found by the Americans in France who formed a committee for investigation. It was given as *LACK OF FRESH AIR.* The French are far advanced in the science of anaesthesia and surgery, but backward in sanitary matters. The committee proceeded to educate the public on the value of fresh air and now "windows are being sawed in hundreds of peasants' homes which boasted of none before the war. The propaganda of fresh air and sanitation is having its effect."

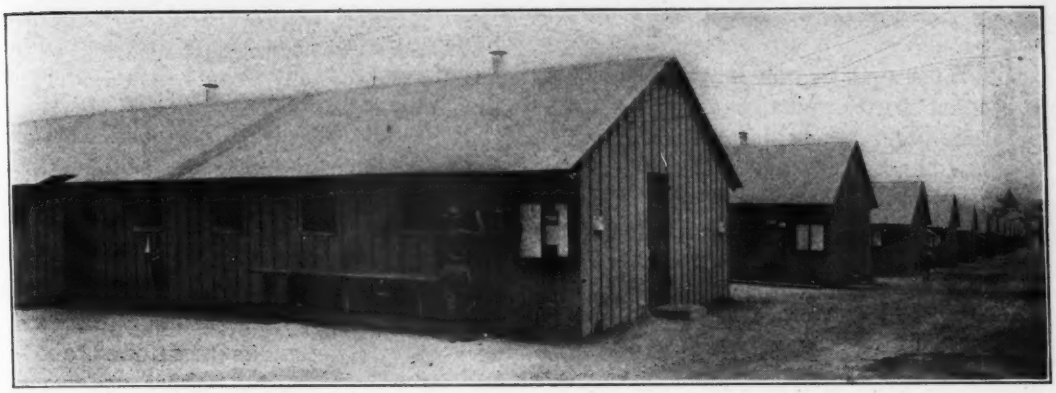
"Nothing has proved more discouraging to the fighting forces in Europe than the verdict of the army physician—'wounded with tuberculosis'—a verdict which should be to Americans both a call for help and a cry of warning."

The science of warfare from a standpoint of destruction of life and property has progressed to a most terrible degree in the present war. The medical profession, too, has made wonderful progress, but the biggest discovery that the medical profession ever made is that "an ounce of prevention is worth a pound of cure."

Longmore's and other tables show that in the wars of the past two hundred years, which were for a prolonged period, 20% of the total deaths were from bullets and 80% from disease, and compar-



TEMPORARY BARRACKS FOR OFFICERS' RESERVE TRAINING CAMP.



VIEW SHOWING CONSTRUCTION OF BARRACKS AT OFFICERS' RESERVE TRAINING CAMPS.

ing this with our Spanish-American war, 7% of deaths were from bullets and 93% from disease.

SPACE STANDARDS FOR SOLDIERS.

Feeble attempts have been made to establish standards for armies of various countries. The cubic feet of space allowed per soldier in barracks has varied from time to time, and in various countries, but the general tendency has been to increase the space:

DETAIL OF BARRACKS FOR OFFICERS' TRAINING CORPS.
Windows Open Horizontally.

French infantry	421	cu. ft. per soldier.
French cavalry	491	cu. ft. per soldier.
Prussian army	631	cu. ft. per soldier.

The English government found by Royal Commission that 600 cu. ft. was sufficient, provided "local position of barracks be open and airy; the structure of the building simple and admitting free external air and internal movement of atmosphere, and provided the barrack rooms as well as all internal parts of the building are duly ventilated." This shows that the subject has been given some thought, but what engineer would specify "admitting free external air, allow internal movement of air and the building shall be duly ventilated?" This, however, has been made a part of the regulations of the English army. An inspector must inspect monthly, examining the ventilation, heating, light, latrines, closets and all other parts. Besides this, the regiment details a certain number of men to give these points a daily inspection.

MESS HALL, OFFICERS' RESERVE TRAINING CAMP.
Kitchen at Far End. Stove Heat.

HEATING OF BARRACKS.

Shall the men in our army barracks be subjected to extreme changes in temperature and thus become physically hardened?

At first glance it would seem that to prepare an army for war the proper procedure would be to break away from our artificial manner of living and expose our men to heat and cold alike and pick the survivors as those best fit to serve us at the front; in fact, it has been stated there should be no heat supplied to barracks and that the exposure will harden the men and make them more fit for service.

A statement like this is fundamentally wrong and coming, although unofficially, from men in the army it should immediately be argued down. The first tendency for men in a cold room is to close the windows and fill up all openings with papers and rags and thus prevent the free entrance of fresh air and the exhaust of foul. The next inclination is for the men to huddle in one corner of the room and keep warm by an interchange of body heat. The results on health from this kind of housing are too well known to be discussed at this time.

It might be possible to give orders against the closing of windows and against the crowding of men into corners of the room, as mentioned above, and let us assume that these orders can be followed out to the letter, the following will be the result:

Air that is too cold causes lack of activity, requires more food, causes a lowered vitality, breeds discontent, and the army will show loss of energy and enthusiasm. The argument of "survival of the fittest" is wrong today—the tendency is to conserve and build up.

It is against all good argument and reasoning to house a man in a room

INTERIOR OF BARRACKS FOR OFFICERS' RESERVE TRAINING CORPS.
Heated by Stove in Center.

with a temperature lower than 10° F. above the freezing point of water. A German authority on army camps gives 12° C. or 53½° F. as a minimum.

STEAM HEAT FROM A CENTRAL STATION BEST.

The best system would be steam heat from a central plant and cast-iron wall radiators in the barracks. The temperature should not be too constant, to prevent monotony, and a variation from 45° to 55° F. would be invigorating and conducive to physical activity.

The barracks that are heated by stoves will be subject to considerable drafts. The heat of a stove is local; those being close by will be too warm while those further away will be too cold. A stove requires constant attention and is the source of considerable dust and dirt, not to mention the danger of fire in the building.

BARRACKS AT O. R. T. C.

The barracks that are being built by our government for the care of men enlisted in the Officers' Reserve Training Camps are as follows:

There are four buildings required to house one company, two buildings being used for sleeping quarters, one as mess hall and one for wash rooms, shower room and toilets.

We are chiefly interested in the sleeping quarters or barracks proper. This building as reproduced from measurements and photographs is of wood construction, 125 ft. long and 20 ft. wide. One end is used for office purposes and for officers' quarters and is separated from the remainder of the building by a wood partition extending to the roof. The main portion of the room is used by 80 men and is 111 ft. long.

The roof is quarter pitch, built of ⅞ in. material and covered with roofing felt saturated with asphalt. The sides are ⅞ in. material with batten strips on the outside. The sides are brought within 3 in. of the roof and this space is open, allowing the free admission of air. This space, as well as the doors and windows, are screened.

The windows are 2 ft. 9 in. wide by 2 ft. 11 in. high and there are 28 in the main floor, 13 on each side and 2 at one end. These windows slide horizontally and can be opened their full area.

There are six doors in the main room, 3 on each side. Each door is 32 in. wide by 6 ft. 8 in. high.

The barracks are lighted by electricity with 60 watt lamps, 10 ft. centers, located on the rafters and along the center line of the building.

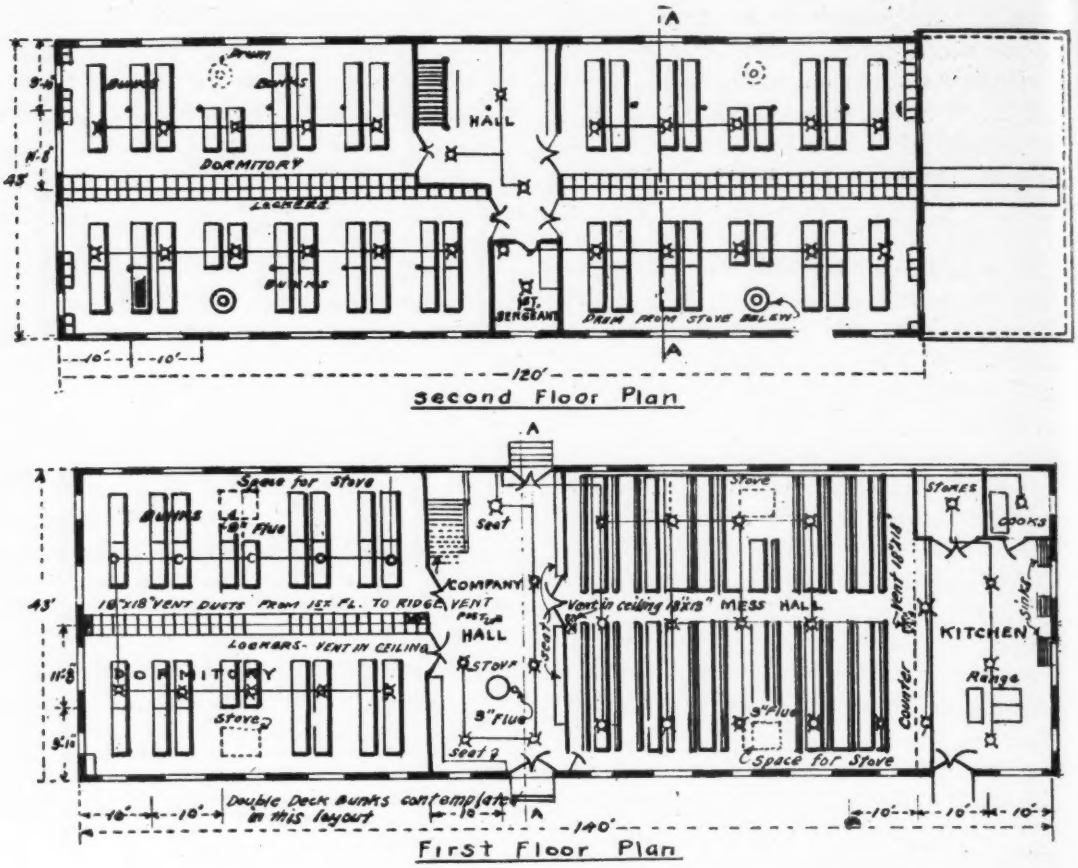
There are four openings in the roof with metal stacks for stove heaters, three being in the main room and one in the office quarters.

The buildings are of open construction and as they now stand would be very unsatisfactory during severe winter weather. This, however, can easily be overcome by lining with wallboard or similar material and allowing an air space between it and the outer wall. The space at the eaves would need to be nailed tight or provision made for opening and closing at will in cold weather.

The cots are arranged along the wall, transversely to the room, with the head end about 6 in. from the side wall. The windows are 42 in. above the floor and at this height is a 12-in. shelf against the wall. This shelf is used for books and other personal belongings and serves as a shield for the sleeper's head from the direct draft of the window.

As there are 80 men in the main room, each man has an allowance of 260 cu. ft. of air space, 28 sq. ft. of floor area and 2.8 sq. ft. of window area. Based on the experience of tests made in other buildings it is predicted that the CO_2 will run as high as 12 parts per 10,000.

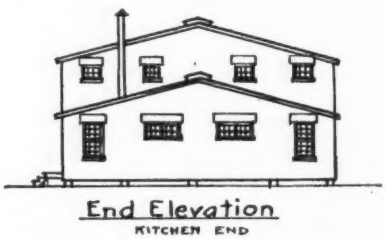
There is no provision for wardrobe, and a rafter on alternate roof trusses makes a convenient place for the men to hang their clothing. This is clearly shown in the accompanying picture. The dust will run high and if the clothing is

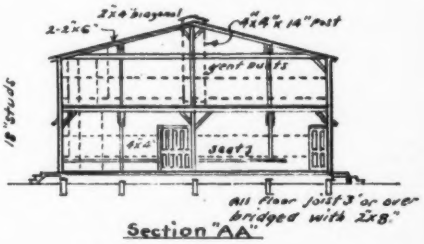


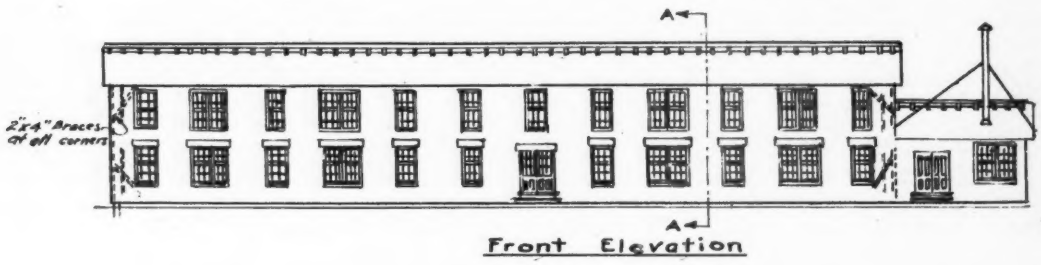
COMPLETE LAYOUT OF A STANDARD COMPANY BARRACKS MEN BOTH SLEEP AND EAT IN THIS WOODEN FRAME BUILDING.

TYPICAL BARRACKS FOR DRAFTED MEN.

Original Plan was for 200 Men. This was changed October 1, 1917, to House 150 Men.







CONSTRUCTION OF BARRACKS FOR DRAFTED ARMY.

damp there will be considerable odors. But the dangerous feature of this practice is the possibility for the spread of disease germs.

The cots are too close together. They are the standard army canvas top cots being 6 ft. 6 in. long, 27 in. wide and about 14 in. from the floor. They are arranged in pairs, 17 in. between pairs, which gives 6 ft. centers of pairs.

The interior of the barracks are smooth-finished but have not as yet been painted or whitewashed.

At each entrance is a shoe scraper about 30 in. long and 20 in. wide, built of 2 in. by ⅞ in. wood strips set vertically with ⅞-in. space between them. This scraper also serves as a door step. It is an excellent device for cleaning the shoes before entering the barracks and helps considerably to keep down the dust.

BARRACKS FOR THE DRAFTED ARMY.

The plans for the barracks for the army of drafted men were disclosed this summer and are shown herewith, as reproduced from the *Engineering News Record* of July 5, 1917. These are somewhat different from the barracks just described. They are two stories high with sleeping quarters for 200 men and each containing its own kitchen and mess room, while the toilets are in separate buildings. The plans have now been changed to house 150 men in these buildings.

Each barrack is 43 ft. wide and 140 ft. long, 20 ft. of which is but one story high and is used as a kitchen. The ceilings are 9 ft. high. On the first floor is a room with 32 double deck bunks, another room as the company hall, and next to this the mess hall with the kitchen at the end. On the second floor are two rooms for sleeping purposes, one for 36 bunks and one for 32 bunks. Between these two rooms are the first sergeant's office and a large hall. Double-deck bunks are contemplated.

The buildings are of wood construction with metal roofs. The side boarding must give a 15-in. clear space above the ground or be carried down to the ground all around.

Lockers are provided in the sleeping quarters and located in the center of the room so as to divide the room into two parts. On the first floor, space is provided for four stoves. The smoke pipe of each stove is provided with a drum on the second floor.

There will be eight vent ducts 18 in. x 18 in. set in pairs and extending from the first floor ceiling to the ridge vent. The ridge vent runs the entire length of the building.

With 200 men there is an allowance per occupant of 300 cu. ft. of air space, 33⅓ sq. ft. of floor area and 4.5 sq. ft. of window area, while with 150 men there is an allowance per occupant of 400 cu. ft. of air space, 44 sq. ft. of floor area and 6 sq. ft. of window area. It is predicted that the CO_2 will run 10 parts per 10,000 unless the windows are very carefully adjusted. The windows are of the double-hung vertical sliding-sash type.

The arrangement of bunks is better than in the barracks previously described, in that they are further from the wall, but it is still a question in the minds of some whether double-deck bunks are as satisfactory as the single.

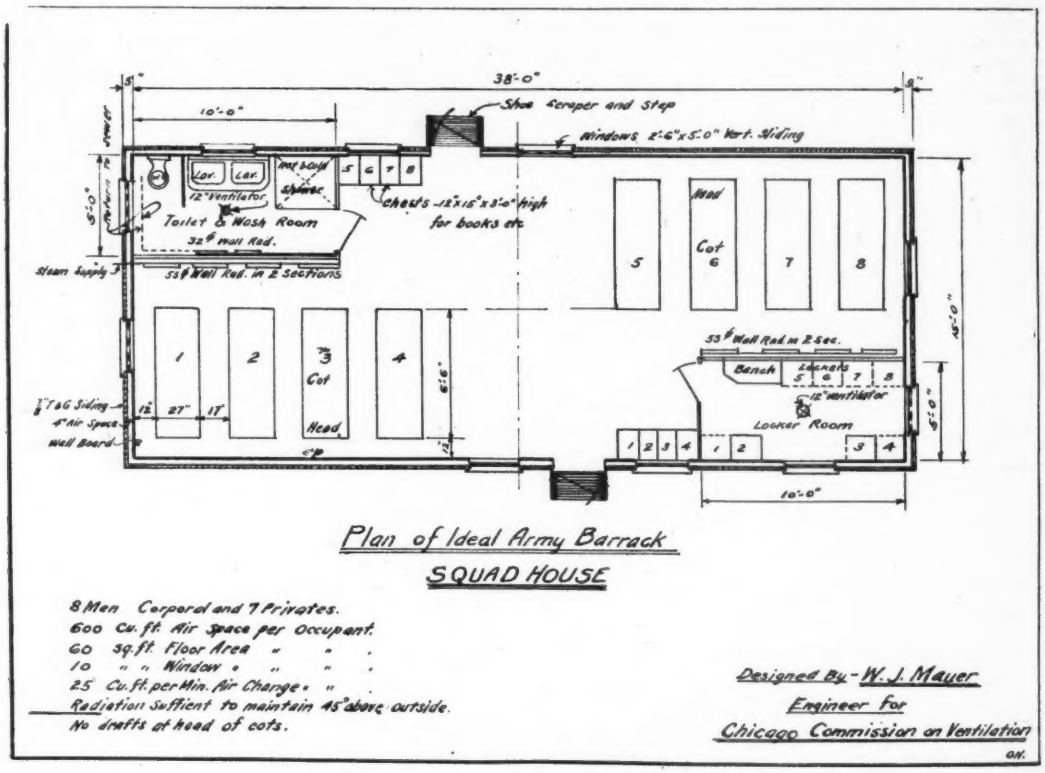
The dust count will probably be high because of the presence of lockers all through the center of the room. Men will come from out-of-doors and their clothing will be dirty or dusty and there will be a great temptation to brush the clothing or shake it on placing same in the lockers. It seems that both from a dust and bacterial standpoint it would be much better to have the lockers in a separate room by themselves, as for instance in the hall shown on the second floor.

The heating system was also changed from stove heat, as at first proposed, to steam heat. This is a very important change, the advantage of steam over

stove heating having apparently been recognized.

In Dr. John S. Billings' report dated 1868 the following was read with a great deal of interest: "Dr. Craig's test for air conditions in a barracks is simple and practical," and it is described as follows: "Go into the room about 3:00 a. m. after 15 minutes walk in the fresh air. If no musty, unpleasant odor is perceived under such circumstances, the ventilation is probably satisfactory."

The barracks as described above will probably pass the test as outlined by Dr. Craig. This test, however, would prove no more than the taste of water would disclose the presence of typhoid bacilli.



PLAN OF PROPOSED SQUAD HOUSE.

SUGGESTED SPECIFICATIONS FOR ARMY BARRACKS.

Dr. Arthur Reynolds, former Health Commissioner of Chicago, gives some very valuable suggestions in his article on "Ideal Training Camps," which article appeared in the July, 1917, issue of *The Chicago Medical Recorder*. One suggestion is to limit the barracks to two men. There would be a lack of sociability among the men and for this reason and several other reasons it seems that a *Squad House,* caring for eight men (a corporal and seven privates) would be more desirable; this number, however, should be the maximum.

The *Squad House* shall contain eight bunks with a separate room for wardrobe at one end and toilets at the other. It should not be necessary for a man to leave the building for toilet or washing purposes. There shall be windows on all four sides of the squad house. A detailed drawing of the squad house as designed by the writer is shown herewith. It will be noted that with the arrangement of windows, radiators and cots no man will be subjected to drafts at his head. The allowance of window space, floor space and air space per occupant is that which is necessary for proper housing.

The *Temperature* shall vary from time

to time between 45° and 55° unless the outside temperature is below 10°, under which condition 40° above outside temperature shall be maintained.

Heat shall be supplied from a central steam heating plant, with a proper amount of radiation in the squad house to furnish the above temperature and still allow the windows to be opened sufficiently to supply at least 25 cu. ft. of air per minute per occupant.

The following shall be a minimum allowance per occupant:

600 cu. ft. of *Air Space.*
60 sq. ft. of *Floor Area*
6 sq. ft. of *Window Area.*

Dust shall not rise to more than 5,000 particles per cubic foot.

Bacteria count shall not be over 4 on 3½-in. Petrie dish exposed two minutes.

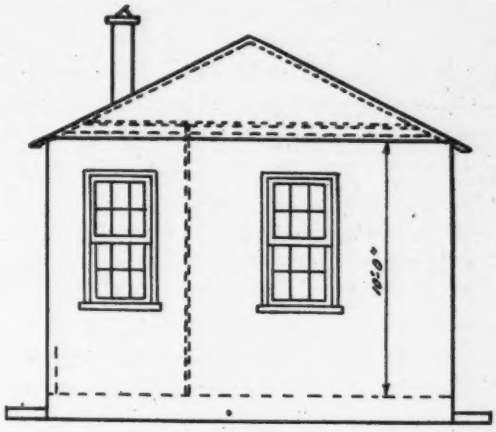
There shall be a 95% freedom from *Odors.*

The *Windows* shall be double-hung vertical sliding-sash type, capable of being opened both at top and bottom so that the air may be introduced at a high point and may be thoroughly diffused before coming into the breathing zone.

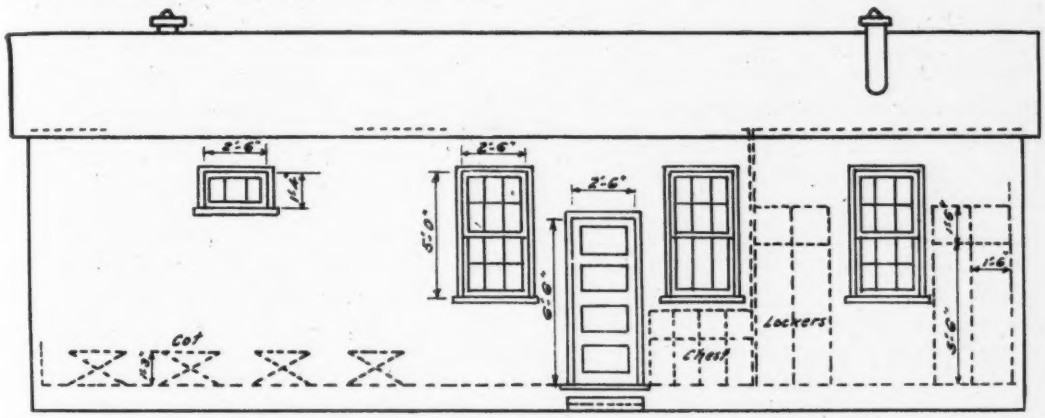
The windows shall be on all sides of the building to secure a uniform *Distribution* of fresh air throughout the room. The sill shall not be less than 3 ft. above the floor.

The *Cots* shall be uniformly distributed throughout the squad house and shall never be placed closer than 9 in. from any wall.

There shall be a separate room for the men's WARDROBE and a separate room for the TOILET, preferably at one end of the squad house, and care should be taken that the air supply to the sleeping quarters is not affected by these rooms.



END ELEVATION OF PROPOSED SQUAD HOUSE.



SIDE ELEVATION OF PROPOSED SQUAD HOUSE.

All interiors shall be smooth finish and shall be *Painted* or *Limewashed* before occupancy and every three months thereafter.

Dust Pockets shall be avoided and care taken to keep the room free from dust and dirt.

The above scheme was worked out by the author and presented by him to the Chicago Commission on Ventilation at their regular meeting on July 24, 1917, and received its unqualified approval.

A Survey of Cloth-Window Ventilation

In the winter of 1912-13 the writer equipped one room in Sumner School, Syracuse, N. Y., with cloth-window ventilation, writes John B. Todd, in *School and Science.* Their use proved a surprising success in every way and finally the entire school was equipped. It was found that the school was ventilated much better than under the fan system. The saving of the power bill for the year was $320.00 and they burned 25 tons less coal. It was thought at first that more coal would be required as the air was so much fresher and free from odors, but raising the lower sash for the screen converts the upper half into a storm window and prevents heat loss; besides, all the heat loss in the ducts and apparatus is saved.

From this experiment in one room of forty-five pupils in 1912-13 Syracuse has (1915-1916) twenty-one schools equipped. The registration of these schools is 11,877 pupils.

Among these schools are every variety of heating apparatus—old buildings with half a dozen hot-air furnaces, to modern buildings heated by steam. The coal consumption of their twenty-one schools for five years under the old forms of ventilation was taken, together with mean temperature and wind velocity during the cold months of the year, and this was compared with coal consumption, mean temperature and wind velocity of the same schools for the same months of 1915-16 when they used cloth-window ventilation. Notwithstanding that the winter was exceptionally severe, in both low mean temperature and increased winds, there was a very substantial saving of coal, which, by very conservative estimates, amounted to 185 tons.*

There was also a very substantial saving of fan power as compared with the average cost for five previous years. Only seven of the schools have fans, and only one of the seven was completely equipped with screens, so that the fans were run more or less in six schools. But the saving in electric power bills for running the fan averaged $1.61 per screened window in the entire seven, and in the one school that was so well equipped with screens that they did not run the fan, the saving was $3.93 per screened window, so that the screens in this school paid for themselves the first year and also returned 100% profit on the investment.

The humidity of these rooms is nearly that of the outdoor air while its dust is 33% less.

In Sumner School, which has eighty-two screened windows and did not use the fan, the coal showed a saving of 25 tons for the year 1914-15. The school became popular as a fresh-air school and was so overcrowded that classes had to be established in the auditorium. To heat this required 20 or 25 tons, but even then the total consumed was ten tons less than used in 1912 and 1913 and the saving for the year was 30 or 35 tons.

Greeley, Colo., school board is using cloth-window ventilation in all of the grammar schools and in the high school. They have been using this form of ventilation three years and it has given such satisfaction that each year additional rooms are equipped. Dr. J. H. Miller, the medical superintendent, states that the attendance and health have been exceptionally high.

Rochester, Minn., has one school equipped. Superintendent H. A. Johnson writes that the teachers "are much pleased with this manner of ventilation."

Wellesley, Mass., Chas. A. Sibley, chairman school committee, writes that

* This work was done by Professor M. R. Sanford, of the U. S. Weather Bureau at Syracuse University.

they have cloth screens in two schools and are planning to extend their use.

Solvay, N. Y., has its schools ventilated with cloth screens. Superintendent Philip W. L. Cox states that they were made by the boys under the direction of the shop superintendent at the Solvay High School.

Oneida, N. Y., has every room in every school equipped with cloth screens. The superintendent of schools writes that "they save all drafts on the pupils and provide a very satisfactory ventilation."

Middletown, Conn.; For two years they have used cloth-window ventilation. Miss Brazos, of the Mount Vernon School, writes that they have been in use in all kinds of weather and are very much liked. She notes the freedom from infectious diseases and the comfortable air conditions.

Vicksburg, Miss.: Dr. E. F. Howard writes that the use of cloth screens has enabled the school windows to be kept open all winter, also that he has five bedrooms screened—the result is "complete success and satisfaction."

Plymouth, Mass., schools have started in the use of cloth-window ventilation.

Ithaca, N. Y.: Cloth-window ventilation is being used in the Home Economic Building, College of Agriculture.

Auburn, N. Y., is getting cloth-window ventilation, and reports it to be of considerable value in securing a larger supply of fresh air than was otherwise possible.

In Oakland and San Diego, Calif., cloth-screen open-window ventilation is used successively in cold weather.

New York City, School 51 Bronx: Hugh J. Smaller, principal, writes: "In reply to your inquiry concerning the use of cloth screens in the windows of this school, would state that here it was a dismal failure. The teacher went home ill several days, suffering from headache, and the general effect on the class was very unsatisfactory." In a postscript he adds: "The screens were only in use in one room and had to be removed for the health of the children." When asked for particulars I received a note from the teacher of the room addressed to "to whom it may concern" when referring to "wind deflectors" tried in her room, stating that they shut out too much light and that the air became offensive, causing headaches, dullness and listleness. One can hardly tell whether they ever used cloth-window ventilation or not, for while the principal speaks of cloth screens, the teacher refers to wind deflectors. It is evident that they did not have 1 sq. ft. of cloth screen per pupil, for a room so ventilated is never offensive; on the contrary the air is always sweet and wholesome. As to the lighting, in a room that has an adequate window space the lighting is improved by the diffused light of the screens.

In striking contrast with the "dismal failure" at 51 Bronx is the report from Stockton School, South Orange, N. J., where they have two rooms with six windows each. The teacher states that the work has been a success. That she had honor attendance during the severest weather, when older children in ordinarily ventilated rooms were out. There was complete absence of colds and grippe or communicable disease and only a single case of sore throat.

Practically all the pupils have gained. One girl weighing 52 lbs. at the beginning of the term, weighed 75 lbs. in the spring. The teacher states: "The only things which have caused friction have been educating the parents to the proper clothing and feeding of the children and the attributing of minor upsets to the *open-air* room. In these respects I have been a real pioneer, but have succeeded. Personally I feel that I am in better health than I have been in eight years. Previously I have lost my voice once or twice each year by laryngitis, but I haven't had a single attack this year. I weigh more than I did a year ago. I have had only one cold and that, strange to say, was during vacation." She states that in the work the children are alert

and that the rooms have attained a standard of "excellent."

There are teachers who have spent years in dusty, ill-smelling rooms and have become so accustomed to it that they can not think of an open-air window, but even those teachers will finally get the fresh-air idea if they can have an opportunity to visit fresh-air rooms and observe the benefit derived.

CONSTRUCTION OF CLOTH SCREENS.

The really satisfactory screen has a substantial wood frame that fits closely into the window frame, so that there are no openings or cracks to let in cold drafts, and covered with Piquot or Black Rock unbleached cotton cloth. There are screen builders in every city who can make them correctly from the drawing. In many schools the pupils make and install them in the buildings. This is a valuable, practical demonstration of applied hygiene and will be reflected in their homes.

There are a number of "ready-made" cheap screens on the market which are of some value in sleeping rooms, but as the cloth is too flimsy for cold weather and the window can not be raised or lowered when they are in use, they are not as satisfactory as one could wish. One firm in Detroit manufactured and sold 300,000 of the low-priced screens last year, which as an index of the fresh-air idea is very gratifying.

CONCLUSIONS.

Following are some of the conclusions reached by Mr. Todd:

Cloth-screened windows one square foot per pupil furnish an abundance of pure air in cold weather.

There is one-third less dust in the room. The humidity is about that of the outdoor air.

Schools with cloth-window ventilation show a remarkable absence of infectious colds and sore throat.

The children are more alert and do better work, discipline is improved.

They can be used with advantage in any school but are of most value in buildings having steam radiation under the windows.

Cloth-window ventilation is merely the open-window method of ventilation in cold weather when the open window would be uncomfortable.

It is ventilation by diffusion of the air through the cloth. The incoming air is broken into currents of infinitesimal size and low velocity with no drafts.

The grade of unbleached cotton cloth branded Piquot or Black Rock is the right quality.

In a longer or shorter period cloth air screens become filled with dust and should be replaced with new cloth. The expense is slight. The old cloth can be washed and when lightly saturated with paraffine or machine oil makes valuable dustless dusters.

Next to a screened sleeping porch, cloth-window sleeping rooms give the greatest satisfaction. One has much greater resistance to infectious colds and lung diseases; besides one's nutrition and energy is increased.

Instead of larger and more expensive schools we should build one-story cottage or at least small one-story schools, and eliminate all mechanical apparatus by designing them for cloth screens. This would be economy and hygienic and educational efficiency. In the large schools we are putting too many eggs into one basket.

The load of a school is the risk—fire, panic and all infectious diseases. In a large school this risk is at maximum, in the cottage or small one-story school at the minimum.

One-Pipe Gravity Steam Heating Systems

Higher Costs Cause Revival of Its Popularity—Essential Points of Design.

By HAROLD L. ALT.

The continued rise in cost of both labor and materials is the direct cause of an increasing interest in the one-pipe steam heating system. There is no doubt that the one-pipe system is the cheapest to install of all heating schemes ever devised, with the exception of stoves, fire-places and warm-air furnace systems, which will be considered as obsolete in the present discussion, due to their lack of economy in fuel consumption.

As is well known, the one-pipe system may be installed in several different ways and involves the use of only one control valve and one pipe connection to each radiator; of course, automatic air valves are used for relieving air the same as on the ordinary two-pipe system. As far as labor is concerned, the increase of one pipe size in the steam supply does not produce an appreciable difference in work of installation and the added cost of the pipe is small; in exchange for this all return valves, return risers and (to a greater or less extent) all return mains in the basement can be omitted, resulting in a considerable economy over the cost of a two-pipe job.

While not the most satisfactory method in operation, the *true* and *complete* one-pipe system throughout involves the use of a single steam main of enlarged size to accommodate the condensation in the bottom of the main, instead of a separate return pipe; the idea also assumes that the condensation will flow in a direction opposite to the flow of the steam which is, of course, not ideal. As a general rule, the smaller the quantity of water so flowing, the less will be the trouble resulting therefrom.

TRUE ONE-PIPE SYSTEM AND MODIFICATIONS.

With the true one-pipe system *throughout* the steam main, risers and branches all pitch back to a point near the boiler where the condensation is al-

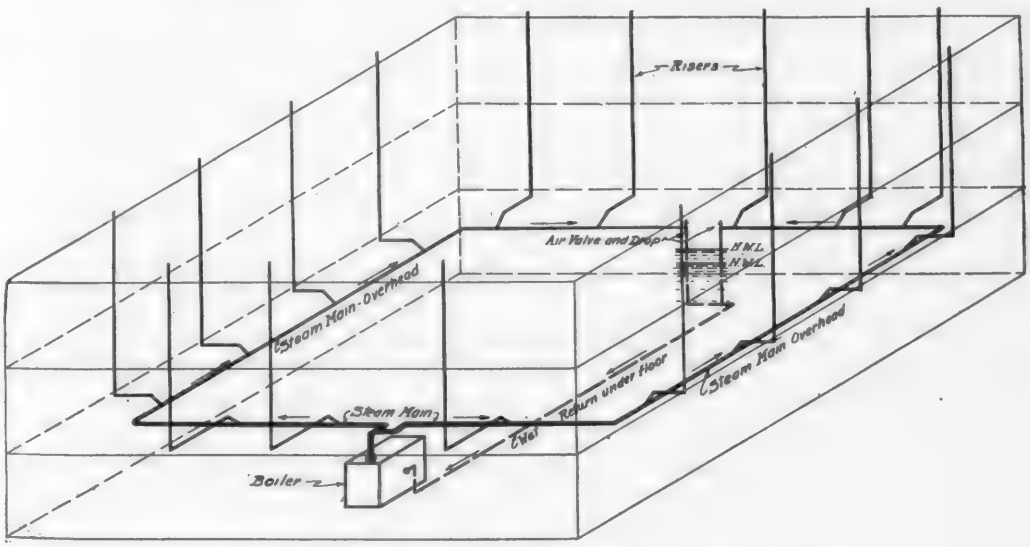


FIG. 1.—THE "CIRCUIT MAIN" ONE-PIPE SYSTEM.

lowed to separate itself and to drop down under the water line, returning to the boiler through the regular return connection. Such a system is seldom used, except for small residences, owing to the large quantities of condensation bucking against the flow of steam in the mains, and the slight modifications necessary to eliminate this are almost invariably adopted for any work of importance.

To obviate this difficulty what is known as the "circuit main" system has been used with great success. In this scheme, as shown in Fig. 1, the radiator runouts, risers and branches are left pitching down from the radiators and against the steam flow, but the steam main—the point of greatest trouble—is pitched *with* the flow of the steam so that the condensation flows along *with* the steam, instead of against it. At the end of the steam main run a drip pipe, or "bleeder," as it is commonly called, is dropped down below the water line and carried back as a wet return. In Fig. 1 and other drawings the pipes are pitched *down* in the direction indicated by the arrows and it is hardly necessary to say that all pockets should be avoided by the use of eccentric fittings or flanges while expansion must be properly cared for both on the steam and return main and in the radiator connections to the risers. This article is intended to cover the particular features relating to one-pipe design, rather than to discuss the elementary features of installation which apply to all steam systems, regardless of their type.

It will be noted that with the exception of the runouts and riser branches all of the condensation flows with the steam and as long as the risers do not get too big—*i.e.*, have too much radiation placed on them so as to produce an excessive quantity of condensation flowing back down—there is no difficulty experienced with this piping arrangement. For larger jobs, where the area is considerable, but the height of the building low, a system termed the "one-pipe relief" system is used. This is illustrated in Fig. 2 and consists of a steam main run around the basement ceiling similar to the main shown in Fig. 1 and pitched *with* the flow of steam. Every riser in this scheme is dripped at the bottom and is supplied by a runout taken from the bottom of the steam main so as to drip the main at every riser connection. Thus the steam main does not carry any con-

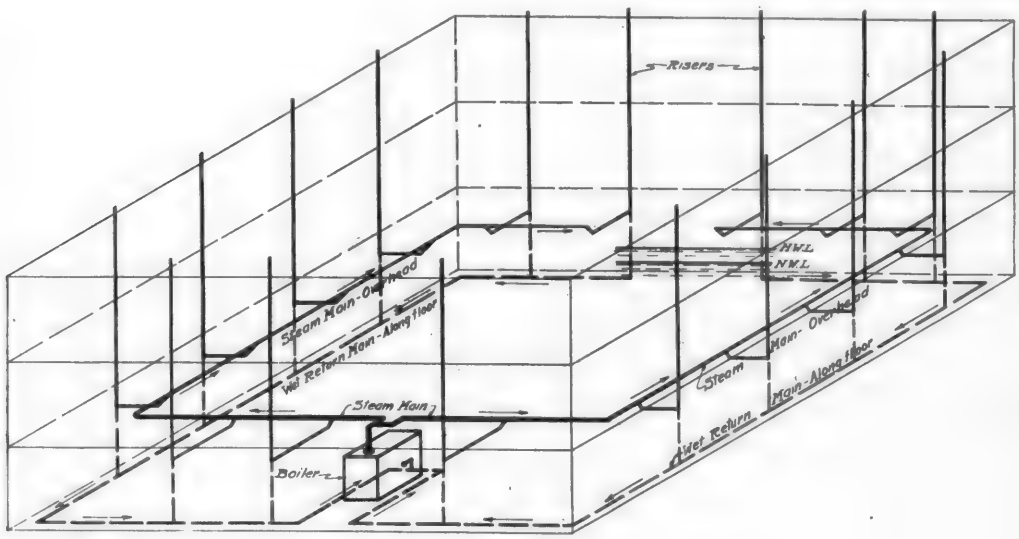


FIG. 2.—"ONE PIPE RELIEF" SYSTEM.

densation from the radiators and has its own condensation dripped at frequent intervals.

The return mains for the "one-pipe relief" system are usually run along the walls near the floor and as nearly under the risers as practical. The return should be a *wet* return, but if a dry return is absolutely necessary the drips should all be water-sealed before connecting thereto.

For jobs where the quantity of radiation goes up to, say, over 600 sq. ft. per riser, it is better to use the overhead or "Mills" system. This system and the "one-pipe relief" system more nearly approach a two-pipe job, having both steam main and a return main, but can be made in the one-pipe variety by using one radiator connection, with a single valve. A diagram of the well-known Mills system is shown in Fig. 3 and it will be noted that all the steam is carried up one main riser to overhead mains run around the top of the building and pitched down from the main riser to the various drops. The drops have tees at the required points of radiator supply and the condensation from the main at the top, from the riser itself and from the radiators connected thereto, falls down through the drops—flowing *with* the steam all the way—and is finally drained off through drips connected to the bottom of the drops and going to the main return—preferably a wet return—through which they find their way back to the boiler.

The Mills system, as can readily be seen, establishes more ideal conditions and should be used for higher building jobs, since the only portion of the piping in which the condensation is flowing against the return is in the radiator branches between the drops and the radiators. On the other hand, the Mills is a more expensive system to install than either the "one-pipe circuit" or the "one-pipe relief," but in spite of this should be used for all larger work where the other two systems would be liable not to give satisfaction.

TYPICAL DETAILS OF PIPING.

Having the general idea of the three schemes in mind, a few typical details will go far to assist in making a perfectly-operating plant. A system which is theoretically correct, but wrong in small details, never gives satisfactory service any more than a system rightly installed in the details, but theoretically wrong in the general idea.

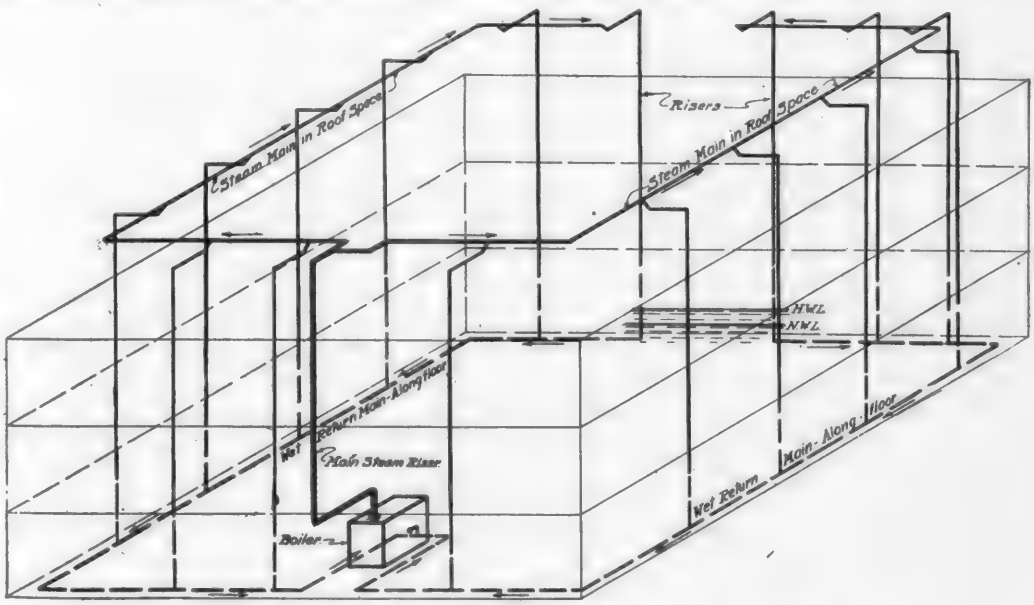


FIG. 3.—THE "MILLS" ONE-PIPE HEATING SYSTEM.

In all one-pipe work the steam connection to the radiator is practically alike; the connections must be made at the bottom and must be controlled (as shown in Figs. 4 and 5) by a gate valve or angle globe valve looking down, both of these points being determined by the necessity of accommodating the flow of the condensation out of the radiator. The automatic air valve should be placed on the opposite end of the radiator from the steam valve and about one-third to two-thirds of the height of the radiators above the bottom. The runouts, of course, must be arranged to provide for expansion in the riser.

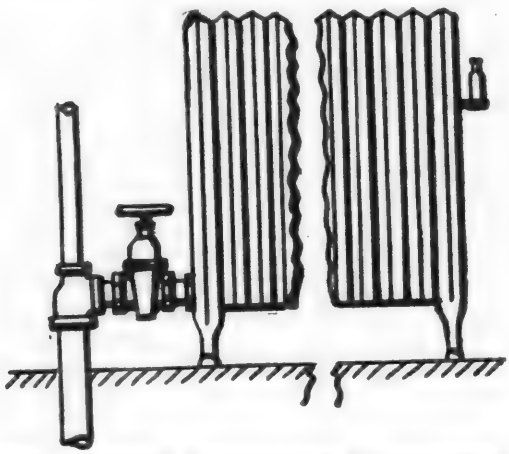


FIG. 4.—STEAM CONNECTION TO RADIATOR FOR ONE-PIPE SYSTEM, USING GATE VALVE.

For the "circuit" system (see Fig. 1) where the steam main drops down under the water line, an automatic air valve should be placed to relieve the air caught between the advancing steam and the water seal, when starting up the system. Otherwise, the air so pocketed will interfere with the return of the condensation and cause all sorts of hammering and trouble. Best results are obtained when the air valve is installed as shown in the detail, Fig. 6. In the "relief" and mills systems, no such air valves are necessary but are sometimes used at the end of the large steam mains merely as an aid to help relieve the air more quickly when starting up.

The steam runouts from the steam mains to the risers or radiators in a "circuit" system should be inclined down from the radiator or riser to the main and should enter the main at 45°, as shown in the detail drawing, Fig. 7, thus allowing the return condensation to flow

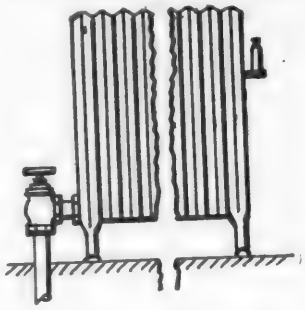


FIG. 5.—RADIATOR CONNECTION WITH ONE-PIPE SYSTEM, USING ANGLE GLOBE VALVE.

along the bottom of the runout and down into the steam main without cutting across the path of the steam flow in the main. If the connection is made as shown in Fig. 8, the pouring into the steam main of the returning condensation is likely to interfere with the flow of steam therein.

The runouts for a "relief" system

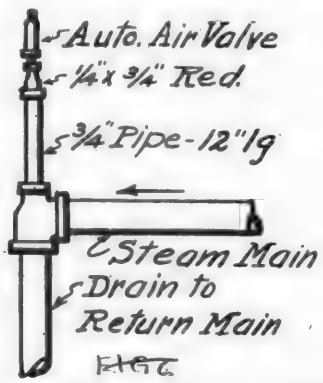


FIG. 6.—BEST LOCATION FOR AIR VALVE IN ONE-PIPE SYSTEM.

should be inclined in the opposite direction toward the drip connection at the base of the riser, as shown in the detail, Fig. 9. It is practical to have these leave the main vertically downward but the 45° connection is more popular. The runout from a steam main in the Mills system is generally arranged as shown in detail Fig. 10, and slopes towards the steam drops.

SIZING OF PIPES.

Having the general scheme of piping and the proper details for connections the next point is to determine on the proper size of pipe. It is easy to see that a riser feeding steam up against the down-coming condensation, in order to avoid excessive velocity, must be larger than a riser on the Mills system, where no such opposing movement exists. Also, that a main carrying condensation and

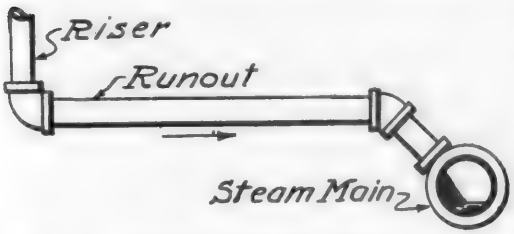


FIG. 7.—CORRECT METHOD OF MAKING RUNOUT FROM STEAM MAINS TO RISERS OR RADIATORS.

steam—such as the steam main in the "circuit" system—must be made larger than one supplying steam only. As is well known, steam at atmospheric pressure, when condensed into water, occupies only a very small proportion of its original volume; in fact, it is roughly correct to say that a cubic foot of steam gives a cubic inch of water when condensed, or its liquid volume is about 1/1728 of its volume as a gas.

If the steam is assumed as flowing at a rate, say, of 2,000 ft. per minute and the return at a rate, say, of 100 ft. per minute, and 2,000 cu. ft. of steam per minute is being handled, then the area of pipe *for the steam* will be 2000/2000, or 1 sq. ft. The steam when condensed

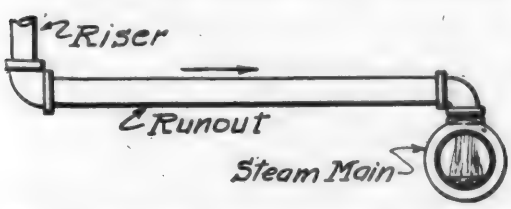


FIG. 8.—WRONG METHOD OF MAKING RUNOUT CONNECTION.

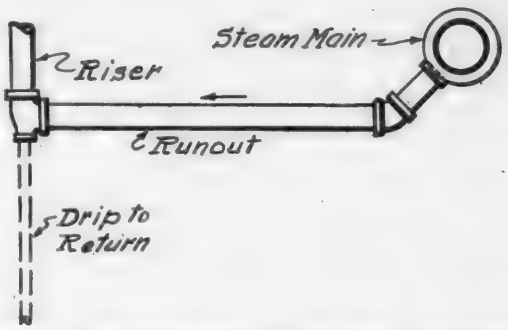


FIG. 9.—RUNOUT FOR A "RELIEF" SYSTEM

will occupy roughly 2000/1728 = 1.15 cu. ft.

1.15 cu. ft. at 100 ft. velocity per minute equals 1.15/100 = 0.01 sq. ft. of pipe area.

Therefore, the actual increase required in the size of steam main is next to nothing, but in the "circuit" system it is customary to run the main either full size to the end drop or nearly full size, reducing at the most not over two pipe

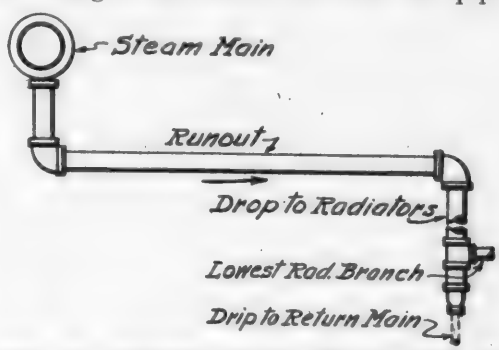


FIG. 10.—RUNOUT FROM STEAM MAIN IN "MILLS" SYSTEM.

sizes.

With the "relief" system and also with the Mills, owing to the condensation not being carried in the steam main, no consideration need be given at this point. In all cases where the flow of condensation is against that of the steam—such as in radiator branches and riser runouts—the pipe is made one size larger than the steam supply which would be used for a common two-pipe system.

Therefore, in order to size a one-pipe job it is necessary to base the sizes on those which would be used for a two-pipe system; the determining factor in

all steam pipe sizing is the allowable drop in steam pressure in which the job permits. For example, a system in which the drop in pressure can be made 5 lbs. will utilize smaller pipe sizes and will be more economical to install than the same system designed for a 2-lb. drop owing to the fact that the lower drop requires larger size pipe to reduce the pipe friction to the extent required.

Fig. 11 illustrates a diagrammatic elevation of a one-pipe system, assuming a 1-lb. drop in the steam line between the boiler and the end of the line in times of maximum load. Thus, with 5 lbs. at the boiler and 1 lb. loss in the line, the steam pressure at the far end of the line would be 4 lbs. The water in the wet return then has a pressure of 5 lbs. per square inch pressing down on its surface in the boiler and a pressure of only 4 lbs. per square inch pressing down on its surface in the vertical leg connecting with the steam main at the end of the run. This unbalanced pressure must equalize itself and does so by the water rising in the vertical leg until the *vertical column of water* in the leg *counterbalances* by its weight *the difference* between the two pressures; *i.e.*, the pressure loss in the steam pipe.

In Fig. 11 this loss is assumed arbitrarily as 1 lb. and since the weight of a vertical column of water is 0.43 lbs. per square inch for every foot of height, the rise of the water, under the assumed conditions, will be 1 lb. ÷ 0.43, or 2.33 ft. As a general thing, it is customary to allow less pressure drop and to keep 18 or 24 in. between the normal water-line and the high water-line established when the system is in operation. In other words, the lowest point of the steam and the radiation is kept at least 24 to 30 in. above the water-line of the boiler. In Figs. 1, 2 and 3 the normal water-line (N.W.L.) and the high water-line (H.W.L.) is indicated at the point on the return connections farthest from the boiler.

The high water-line should always be calculated to keep at least 6 in. below the steam main or lowest level of radiation, so that, with 30 in. difference, the water rise could not be over 24 in., with 24 in. difference the rise could not be over 18 in., etc. If 1 lb. = 2.3-ft. rise, then 16 oz. = 2.3 × 12, or 28 in. and 1 oz. = 1.7-in. rise. This results in a table for allowable rises as follows:

TABLE I.

Allowable Rise of Water in Return Mains, Inches.	Allowable Loss in Pressure in Steam Mains, Pounds.
3.5	⅛
7	¼
14	½
28	1
42	1½
56	2
70	2½
84	3

When the total allowable loss has been determined, the loss per 100 ft. of run

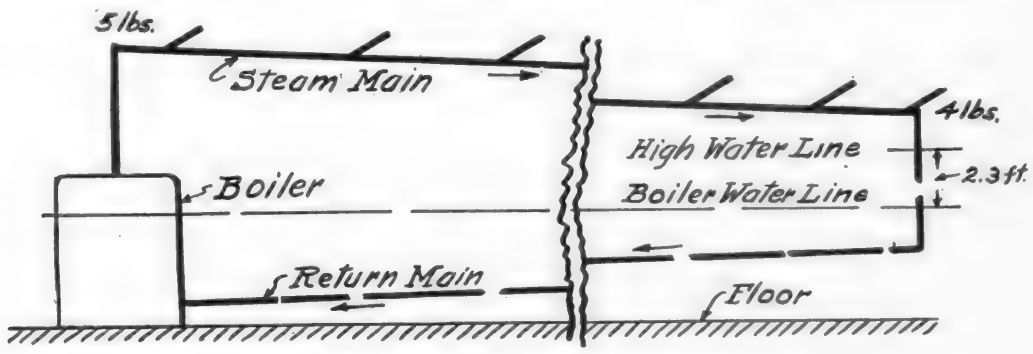


FIG. 11.—ILLUSTRATION OF PRESSURE LOSS IN ONE-PIPE SYSTEM.

must be calculated and the size of main based on tables computed on such losses. For instance, if the allowable rise of return level is 16 in., then, from Table I, 28 in. = 1 lb. drop; and if the total length of run of the main from the boiler to the farthest connection to the return main, plus 25% for fittings, valves, etc., should equal 200 ft. (approx.) then the drop per 100 ft. must be

$$1 \text{ lb.} \div \frac{200}{100} = \tfrac{1}{2} \text{ lb. per 100 ft., or equivalent.}$$

Table II shows the number of square feet of radiation which can be fed by a steam pipe of given size with varying drops in pressure:

with 1 lb. drop, would require a 1½-in. pipe, but, with a ⅛-lb. drop, would require a 2-in. pipe. All indirect radiators and other surfaces not equivalent to a radiation of 250 B.T.U. per square foot per hour should be reduced to such equivalent direct radiation (E.D.R.) and sized on the basis of E.D.R. Thus, an indirect radiator heating 1,000 cu. ft. of air per minute from 0° to 70° F., would give off B.T.U. as follows:

$$\frac{1{,}000 \times 60 \times (70° - 0°)}{55} = 76{,}000$$

B.T.U., roughly.

76,000/250 = 304 E.D.R., and at ½ lb. drop, would require 1½-in. pipe.

On all horizontal branches where the

TABLE II.

Size of Pipe, In. Diam.	Drop in Pressure—Pounds per Square Inch.			
	⅛	¼	½	1
	Square Feet of Direct Radiation.			
1	60	80	130	175
1¼	110	160	225	325
1½	200	280	400	550
2	465	640	900	1,275
2½	840	1,200	1,700	2,400
3	1,400	1,900	2,800	4,000
4	3,100	4,400	6,200	8,800
5	5,730	8,000	11,400	16,000
6	9,200	13,000	18,000	26,000
8	20,000	28,000	40,000	57,000
10	36,000	51,000	72,000	103,000
12	58,000	80,000	117,000	165,000

TABLE III.

Size of Steam Pipe, Diam. Inches.	Dry Return Diam. Inches.	Wet Return, Diam. Inches.
1	1	¾
1¼	1	1
1½	1¼	1
2	1½	1¼
2½	2	1½
3	2½	2
4	3	2½
5	3	2½
6	4	3
8	4	3
10	5	4
12	6	5

Table II has an allowance already included of 25% for loss in mains, so that it reads in E.D.R. (equivalent direct radiation) and no further allowance need be made. Thus, 460 sq. ft. of radiation on the equivalent of a 100-ft. run, condensation flows against the steam, ⅛-lb. loss should be used, plus one pipe size.

Dry returns on small sizes are usually made one size less than the steam pipe supplying the same radiation and, on

large pipe, two or three sizes less, while wet returns are usually made one-half the diameter of the steam pipe, or one-half, minus one pipe size; Table III may be used for consistent relations between steam and return mains.

Oftentimes it is found that the returns are so connected that it is much easier to size directly from the amount of E.D.R. that the return serves. In this case, Table IV may be used.

TABLE IV.

Nominal Size of Pipe, Diam. Inches.	Wet Return. Square Feet, E.D.R.	Dry Return. Square Feet, E.D.R.
¾	800	270
1	1,600	540
1¼	3,000	1,012
1½	6,000	2,024
2	12,000	4,050
2½	20,000	6,750
3	36,000	12,150
4	80,000	27,000
5	...	48,600

While it might seem that the returns are greatly overrated in Table IV, it is customary to increase the wet return sizes one or two pipe sizes to allow for the collection of sediment and blocking caused by corrosion. As a general rule, the wet return is not made less than one-third to two-fifths the diameter of the steam main.

To prove, however, that a wet return *will* carry the amount of water scheduled, it may be figured the same as a sewer pipe where the pressure is equal on both ends and the flow maintained by the pitch in the pipe. For instance, take the 4-in. wet return, rated at 80,000 sq. ft. of radiation; at ⅓ lb. condensation per square foot to allow for mains, the pounds of water per hour would be 80,000/3, or 27,000 lbs. roughly. 27,000/8⅓ = 3,000 gal. plus per hour, or 3,000/60 = 50 gal. per minute. With 9 in. pitch in 100 ft., a 4-in. sewer will discharge 81 gal. per minute, showing that if the water backed up in the return so as to produce 6 in. or 7 in. of head every 100 ft. of run, the 4-in. pipe *would* handle the 80,000 sq. ft. Of course, this 6 in. or 7 in. must be added to the rise in the return previously explained as due to the fall in steam pressure.

For risers with steam flowing against the return from the radiators, as occurs in the "circuit" system and "relief" system, a velocity in the main of 10 ft. per second should not be exceeded. On this basis Table V should be used for upfeed risers.

TABLE V.

Upfeed Risers.

(Velocity of steam, 10 ft. per second.)

Size of Pipe, Diam. Inches.	Sq. Ft. of Radiation, (E.D.R.)
1	30
1¼	60
1½	80
2	130
2½	190
3	290
4	520

With down-feed—such as occurs with the Mills system, an increased velocity of 50% or more is allowable, as shown in Table VI.

TABLE VI.

Down-Feed Drops.

(Velocity of Steam 15 ft. per second.)

Size of Pipe, Diam. Inches.	Sq. Ft. of Radiation, (E.D.R.)
1	50
1¼	90
1½	120
2	200
2½	290
3	340
4	800

Another authority sizes steam risers on a one-pipe system as shown in Table VII.

TABLE VII.

Nominal Size of Pipe, Diam. Inches.	Up-Feed Riser. 5 stories.	Up-Feed Riser. Over 5 stories.	Down-Feed Riser. 5 stories.	Down-Feed Riser. Over 5 stories.
	Square Feet of Radiation.			
1	34	30	60	54
1¼	67	60	112	100
1½	100	90	162	146
2	200	180	260	234
2½	367	330	600	540
3	667	600	880	790
4	1,333	1,200	1,600	1,440

This table, it will be noted, allows much greater loading of risers than Table VI, yet it has been used by one of the best engineering concerns in the country for many years and gives good and satisfactory service.

Radiator connections should be not less than the sizes shown in Table VIII.

TABLE VIII.

Size of Pipe, Diam. Inches.	Sq. Ft. of Radiation. (E.D.R.)
1	24 or less
1¼	24 to 60
1½	60 to 80
2	80 to 130

All horizontal branches over 5 ft. long should be one pipe size larger than the riser to which they connect. This is due to the flow of condensation through the horizontal pipe being retarded.

While it has been previously stated in this article that 25% is allowed as added to the actual length of the main to obtain an equivalent length for the fittings, sometimes the friction may increase to 100% and when more accurate results are desired, the fittings, valves, etc., can be counted and the actual equivalent length computed. For this purpose the friction of each fitting and valve must be assumed as equivalent to an added length of run as shown in Table IX.

A method which can easily be memorized is to allow 60 pipe diameters for the "entrance," each globe valve and each tee, where the steam passes through the branch, and 40 pipe diameters for each 90 ell; tees passed through on the *run* and *gate valves* may be neglected. The "entrance" friction is the friction

TABLE IX.

Fitting.	Size of Fitting. 1-in.	1¼-in.	1½-in.	2-in.	3-in.	4-in.	5-in.	6-in.	8-in.	10-in.
	Lineal Feet of Additional Length to Be Added to Main									
90° Ell	3	4	5	7	10	13	17	20	27	33
Globe Valve	7	8	10	13	20	27	33	40	53	67
Entrance	5	6	8	10	15	20	25	30	40	50

TABLE X.

Radiation, Sq. Ft.	Main Size, Diam. Inches.	Runout and Riser, Diam. Inches.	Radiator Connections, Diam. Inches.
24	1	1¼	1
60	1¼	1½	1¼
125	1½	2	1½
250	2	2½	2
600	2½	3	..
800	3	4	..
1,600	4	5	..
2,300	5	..	..
4,100	6	..	..
9,600	8	..	..

occurring when the steam enters the pipe.

For small residence systems Table X previously published in THE HEATING AND VENTILATING MAGAZINE for April, 1908, will serve as a very complete schedule.

To summarize for each type of one-pipe system, the following tables and drawings should be used, as shown in Table XI.

TABLE XI

For Pipe Sizes of Various Portions of System.

Type of One-Pipe System.	For General Arrangement See	For Detail of Runout See	For Detail of Air Vent on Main See	For Detail of Radiator Connections, See	Supply See	Dry Return, See	Wet Return, See	Risers, See	Radiator Connections, See
Circuit (common)	Fig. 1	Fig. 7	Fig. 6	Figs. 4 and 5	Table II	Tables III and IV	Tables III and IV	V and VII	Table VIII
Circuit (residence)	Fig. 1	Fig. 7	Fig. 6	Figs. 4 and 5	Table X	...	...	X	Table X
Relief	Fig. 2	Fig. 9	None	Figs. 4 and 5	Table II	Tables III and IV	Tables III and IV	V and VII	Table VIII
Mills	Fig. 3	Fig. 10	None	Figs. 4 and 5	Table II	Tables III and IV	Tables III and IV	VI and VII	Table VIII

Oil Burning Equipment for School Boilers.

E. P. Pratt, department mechanic for the Board of Education of Berkeley, Cal., has gathered some interesting statistics on the relative cost of heating school houses with oil and with coal, which are published in *The Architect and Engineer*.

During a period of five years Mr. Pratt kept a record of the cost of heating the Longfellow school building in Berkeley and found that the average cost per year was $167.80. More or less trouble was experienced continually in heating this building, and in the spring of 1915 Mr. Pratt asked permission to install an oil burner on trial. The board consented and a burner was installed and operated during the winter of 1915-16 at a cost of $70. The building was kept at a uniformly satisfactory temperature. There was no dust or ashes and a minimum of labor was required in keeping a proper head of steam. The amount given for heating the building was not really what the oil cost, and forty-five barrels of oil were placed in the tank on the last day of June so as to take advantage of a contract of 60 cents per barrel. Up to the end of January, 1917, the sum of $42 has been spent for additional oil to heat this building, and the amount of oil on hand will carry the building for the remainder of the winter. The cost for the two years will thus be $112 as against $327.60 for the two previous winters when coal was used. The cost of coal in Berkeley is $9.38 per ton.

Mr. Pratt has devised a simple method of checking the deliveries of oil to prevent shortages and overcharges. The oil tanks in the school house basement measure 5 ft. by 14 ft. and contain 2,050 gal. Each janitor has a measuring stick which shows just how many gallons are in the tanks. When a consignment of oil arrives the janitor measures the oil remaining in the tank, and when the delivery has been made he again takes a measurement. By deducting the first from the second amount he can quickly figure the actual amount of oil delivered. By comparing the drivers' delivery slip with his own checking he can readily tally the bill.

Standard Practice in Sprinkler-Heating Systems

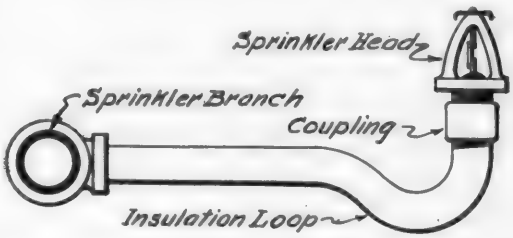
It has long been a common practice in certain sections of the country, notably in New England, to circulate hot water in sprinkler systems installed in factory and mercantile buildings, so that that they may be used for heating the buildings, as well as furnishing a protection against fire. A description of the latest practice in this line of work was presented at the last annual meeting of the National District Heating Association, by E. D. Densmore, an engineer, of Boston.

As is well known, the sprinkler system consists in general of a series of pipes which cover uniformly the ceilings of all floors. If the water which is maintained in the sprinkler system could be heated and circulated, of course this sprinkler piping could be used for heating. One fundamental objection would be that the sprinkler head which is in ordinary use would melt at the temperature necessary for the water if it were to be used for heating purposes. This melting of the sprinkler head is prevented by means of a U connection through which the hot water cannot circulate. It has been found in practice that such a device will prevent the head from melting. A sketch of this insulator or U connection is shown herewith.

In order to make sure that all the sprinkler piping will be an efficient heating surface, it is necessary to connect up the sprinkler mains and runouts so that circulation takes place through all the pipes, as shown in the accompanying diagram.

The connections of the hot water heating system with the sprinkler piping are exceedingly simple and need not change the sprinkler piping in any way. The hot water heater may be located in any convenient place, either in the building to be heated or in an adjoining building. From the hot water heater a hot water supply pipe is run and connected to the foot of the sprinkler riser inside the alarm valve. It is advisable to install a valve at this point, so that the hot water supply may be entirely shut off from the sprinklers when necessary. Between the hot water connection to the riser and the sprinkler heads no changes are made, the sprinkler riser, laterals and distributing pipes being installed in the usual way.

In practice it is found that when the conditions in a building are such that circulating the water in the sprinkler system will give adequate heat, the cost



DETAIL OF INSULATOR CONNECTION.

of the combined system is less than the cost of a separate sprinkler system and a separate heating system. If the sprinkler system does not give sufficient heat it is necessary to add radiators or coils. This complicates the scheme somewhat, but of course up to a certain point additional surface can be installed and still have the combination scheme cheaper.

The general arrangement of the system is such that the water in the sprinkler system is circulated upward through the building and back through the heater. This circulation will take place by gravity when conditions are favorable or it can be forced by a pump. Whatever pressure is on the sprinkler system will of course be on the heating system.

It is necessary to arrange for the expansion of the water. If the building is on a tank this expansion could be taken care of through the tank. The ordinary sprinkler system has check valves on both the tank supply and on the street supply so that some special scheme for expansion is usually necessary. Sometimes a pressure expansion tank is installed or else by-pass connections are placed around the check valve. If cast-iron radiators are to be used, it is to be

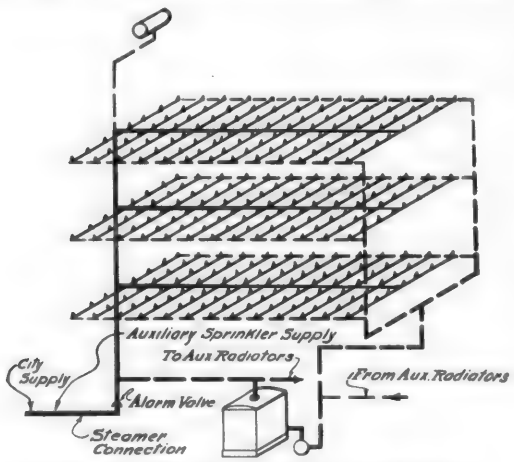


DIAGRAM OF PIPING FOR SPRINKLER-HEATING SYSTEM.

borne in mind that in high buildings the static pressure on the lower floors is considerable.

The advantages claimed for this combination system are simplicity and first cost. These claims would be justified where the sprinkler system would supply the larger part of the heat necessary. It is also claimed that the sprinkler pipes, having water circulating all the time, are less liable to become clogged up. It is also claimed that a uniform distribution of heat is obtained. This is true, but of course it is also true that the heating surface is all on the ceiling which in some cases would not be desirable, particularly where heat is required under windows to prevent drafts.

In general the objections to such a system are that it is undesirable to mix up the fire protection system with anything else. The inspection and maintenance of the fire protection system is of great importance and it is a grave question whether or not it is wise to combine this system with the heating system from the point of view of fire protection. The necessity of having the sprinkler heads connected with the U connections makes it possible for sediment to collect in these U connections since no circulation takes place through this pipe.

In general it may be said that this system offers an opportunity for a wide range of usefulness and it might be expected that as time goes on the field which it will occupy will broaden.

Coal Heat Three Times Cheaper Than Electric in Seattle.

The cost of heating an average-sized house by electricity is about three and a half times as much as heating it by coal. Dr. Frederick A. Osborn, head of the physics department of the University of Washington, has reached this conclusion after experimenting with the two methods of heating in his own home, a seven-room dwelling.

Dr. Osborn has used a high grade of lump coal in a 0.24 Standard hot-air furnace for the past three years. The coal cost $7.75 per ton, delivered in the basement bin. The annual average cost of heating the house for this period of three years was $75.

All the rooms electrically warmed were equipped with the wire-resistance convector type of electric heater. The rate for electric heating was 1c. per kilowatt-hour.

From the tests, Dr. Osborn has determined that electricity selling at 0.29 cent per kilowatt-hour would furnish heat for the same cost as coal costing $7.75 a ton.

Current Heating and Ventilating Literature.

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HIGH-PRESSURE STEAM

Heating and Ventilation at Harrison Tech. Ills. 2,500 w. Prac. Eng., Chi.—Aug. 15, 1917. Steam for heating Chicago Institution at high pressure. 20c.

CENTRAL STATION HEATING

Standard Tests for Condensation Meters.

A form of test has been devised by the Test Committee of the National District Heating Association, which, it is stated, will indicate the fundamental characteristics of any condensation meter now on the market. The method was described at the association's recent convention in Detroit. It is emphasized that the results sought in such tests are the *inherent* characteristics of the meters and should therefore be obtained under as nearly ideal conditions as possible. In other words, the meters so tested should be in perfect condition as regards dirt, lubrication, and adjustment, and no variation of these factors should be allowed to enter into the tests.

The following series of tests were selected as indicating the fundamental characteristics of any condensation meter:

TEMPERATURE-ACCURACY TESTS.

These tests have for their object the determination of the performance of the meter under varying temperatures of the condensation. A constant rate of flow, sufficient to operate the meter at about 80% of its rated capacity was used. The temperature of the water was measured at the meter inlet in the manner shown in Fig. 1. Tests were taken at temperatures ranging from 50° to 210° F. The water was weighed before entering the meter.

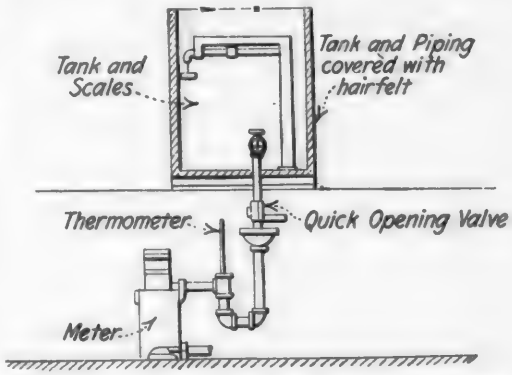


FIG. 1.—ARRANGEMENT OF APPARATUS FOR TESTING CONDENSATION METERS.

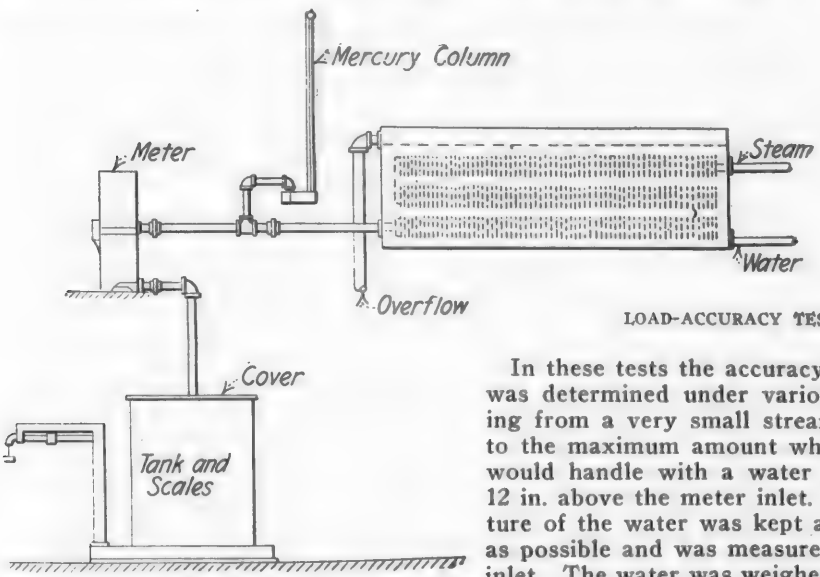


FIG. 2.—ARRANGEMENT FOR MAKING STEAM PRESSURE TESTS.

LOAD-ACCURACY TESTS.

In these tests the accuracy of the meters was determined under various loads ranging from a very small stream of water up to the maximum amount which the meters would handle with a water head of about 12 in. above the meter inlet. The temperature of the water was kept as near 185° F. as possible and was measured at the meter inlet. The water was weighed before entering the meter, as in Fig. 1.

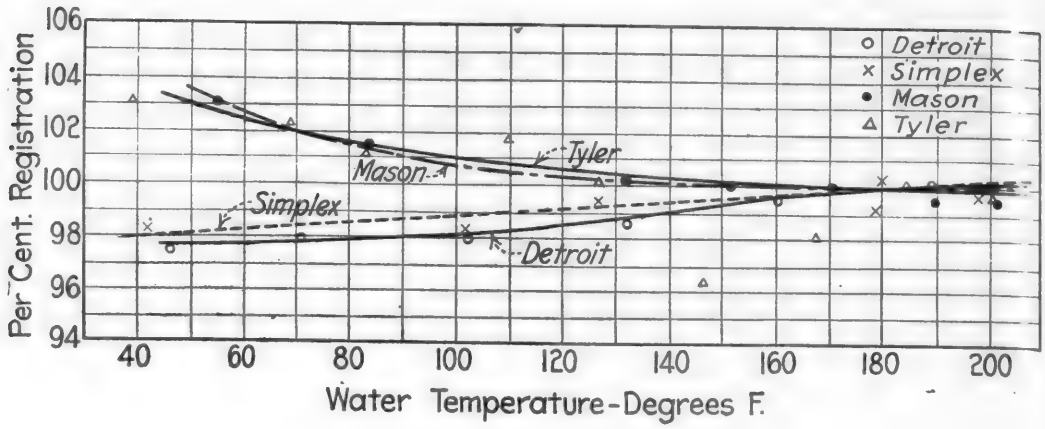


FIG. 3.—TEMPERATURE ACCURACY TESTS.

STEAM-PRESSURE ACCURACY TESTS.

In these tests the meters were operated under conditions similar to those set up by a "blowing" trap. A mixture of steam and water was delivered to the meter in the manner shown in Fig. 2. The pressure of the entering steam and water was measured with a mercury column at a point 6 in. from the meter inlet. A sufficient amount of condensation was used to operate the meter at about 25% of its rated capacity. Tests were made at increasing pressures

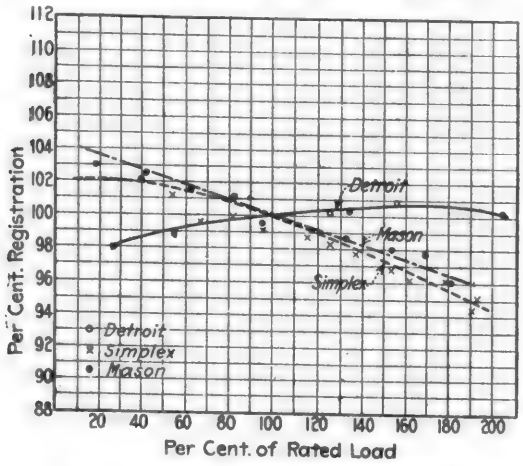


FIG. 4.—LOAD ACCURACY TESTS.
Water Temperature 185° F.

until some occurrence, such as the stoppage of the meter, was noted.

Similar tests were reported by the meter committee in 1914 on the Detroit and Simplex meters. The present committee has conducted tests on the Mason and Tyler meters and made some check tests on the other types. A complete report is given below.

The meters tested were as follows:

Meter	*Made by*	*Size*	*Rated Capacity*
Detroit	Central Station Steam Co.	C	675 lbs. per hour
Simplex	American District Steam Co.	4	750 lbs. per hour
Mason	Gilmore Mason	—	900 lbs. per hour
Tyler	Tyler Underground Heating System	2	800 lbs. per hour

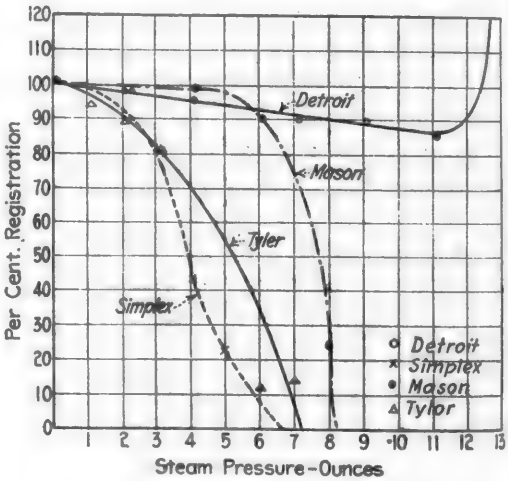


FIG. 5.—STEAM PRESSURE ACCURACY TESTS.
25% of Rated Load.

In ordinary tests, meter accuracy is usually expressed in "percentage of accuracy" which is taken as the weight of water registered, divided by the actual weight. In this case, all of the meters tested varied somewhat from 100% accuracy at rated load and in order to reduce the results to a comparative basis, the actual weight of water at rated load was used as a basis for computing the percentages, instead of the weight registered. By this method all of the curves intersect the 100%

mark at rated load, and the results are comparable.

In the temperature-accuracy tests the actual weight of water which passed through the meter in the standard number of revolutions at 185° was taken as 100% accuracy and this weight was used as a basis for computing the accuracy of the other tests. The temperature-accuracy curves, therefore, intersect the 100% line at 185°.

The temperature-accuracy tests are shown in Fig. 3 and the load-accuracy tests in Fig. 4. Fig. 5 shows the action of the meters under steam pressure. In these last tests it will be noted that the Detroit meter first under-registers and then begins to over-register greatly at about 12 oz. pressure. All of the other meters begin to under-register at a slight pressure and registration practically ceases at a pressure of about 8 oz.

While only one meter of each type was tested, the tests were made with great care.

The Cost of Leaking Steam.

To determine the cost of leaking steam with any degree of accuracy we must know at least four factors: (1) the number of pounds of steam evaporated by 1 lb. of coal; the greater this is, the less is the cost of leaky pipes, other conditions being the same; (2) the total area of leakage; (3) the absolute steam pressure, which is equal to the gauge pressure, plus the atmospheric pressure; at sea level this is usually reckoned as gauge pressure, in pounds per square inch, plus 14.7; and (4) the cost of coal per ton of 2,000 lbs.

For example, how much money is lost every 10 hrs. under the following conditions: 9 lbs. of steam are generated by each pound of coal. The total area of leakage is ½ sq. in. The gauge pressure is 105 lbs. per square inch (making the absolute pressure very close to 105 + 14.7 = 120 lbs. per square inch). The cost of coal is $3.50 per ton.

Referring now to the chart, lay a straight-edge across the chart three times as indicated by the dotted lines and the problem is solved. Run the first line from the 9 (column A) through the 120 (column C) and locate the intersection in column E. Run the second line from that point of intersection to the 0.5 (column B) and locate the intersection in column C. From that point of intersection run the third line to the $3.50 (column E) and the answer is found at the intersection with column D. The answer is $6.00 loss per 10 hrs.

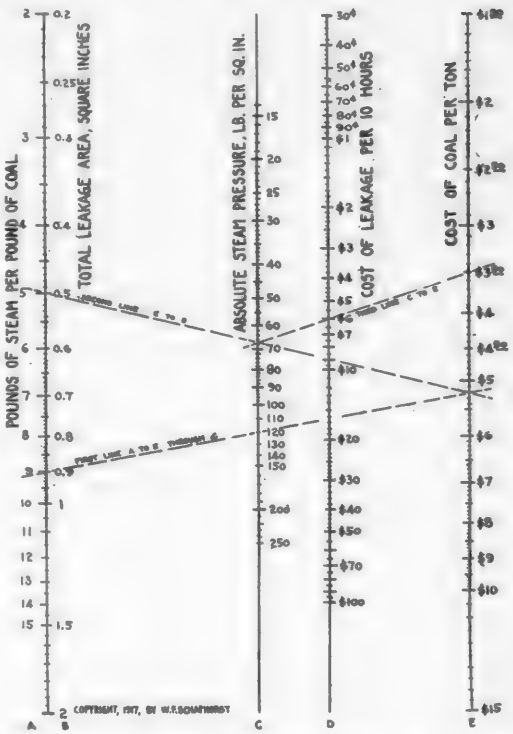


CHART FOR DETERMINING COST OF LEAKING STEAM.

In case it is found that the total leakage area is less than shown in column B, the chart may be used by shifting decimal points. For example, if, in the above problem, the leakage area had been 0.05, instead of 0.5 sq. in. the answer would be 60 cents, instead of $6.00, per 10-hr. day.

When using the chart, the steps must follow in the order shown and above described. First line, A to E through C. Second line, E to B. Third line, C to E.

The range of the chart is great enough to easily handle any ordinary problem.—*W. F. Schaphorst.*

Finds a Coal Mine in His Cellar.

While digging a cellar for a new home in Norton, Wise County, Va., Henry M. Bandy's workmen came across a 4 ft. x 5 ft. vein of bituminous coal of high calorific value, states the *Ideal Heating Journal.* The house is on the side of a mountain, and Mr. Bandy calculates that he has something like 60,000 to 70,000 tons of high-grade soft coal on his property of 150 x 300 ft.

With a few strokes of the pick, the fuel is unearthed and fed to the boiler. A careful calculation indicates that Mr. Bandy is procuring his coal at an average price of 30 cents per ton.

THE HEATING AND VENTILATING MAGAZINE
A Monthly Journal of Engineering Progress
Member of the Associated Business Papers Inc.

Vol. 14 **November 1917** **No. 11**

Published Monthly at Cooperstown, N. Y., by the
Heating and Ventilating Magazine Co.
Executive and Editorial Offices, 1123 Broadway
New York
A. S. ARMAGNAC.....*President*
GUSTAVE PETERSEN....*Secretary and Treasurer*

A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager
HAROLD L. ALT, Contributing Editor

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

Subscription	$1.00 per year
Canada	1.25 " "
Foreign Countries	1.50 " "
Back numbers	15 cents each
Back Nos. prior to current year	25 cents each

THE painful experiences through which many central station heating companies are going in trying to meet the rising cost of coal, labor and pretty much everything else that goes into the maintenance and operation of their plants, has again directed attention to the "municipal ownership idea," which has unquestionably gained ground during recent months. It must be admitted at the outset that, from the standpoint of efficient operation for extended periods, a municipal plant may not be expected to compete successfully with a privately-owned plant. In all previous arguments that has been one of the deciding factors. But now a new situation confronts the industry which, coupled with the growth of State commission regulation, has given pause to more than one utility company.

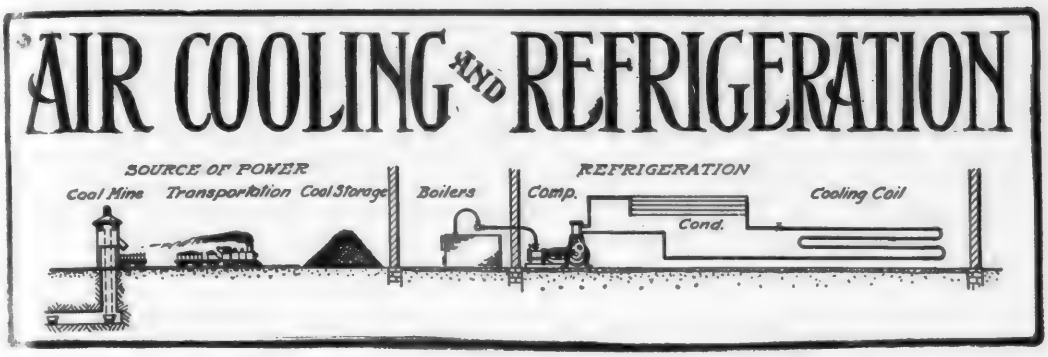
Briefly, the situation is that the companies are finding themselves without the necessary income to meet the big jump in costs. Almost all of them have petitioned the public service commissions for rate increases and it must be said that the petitions generally have been granted, but the great question is, is the relief adequate, and, if not, will it be possible to still further advance the rates in the near future, should such a step become necessary?

To these companies the municipal ownership idea is appealing with a new force, not because of the usual arguments in favor of it, but as a logical sequence of the combination of commission control and extraordinary costs.

It does not seem, however, that any constructive work is to be done in advocating the municipal ownership of central heating plants. If central heating plants can not be made to pay under private management, they certainly could not under municipal management. One might even go so far as to say that any institution of this kind which does not pay should not exist.

In other words, municipal ownership is not a cure-all for bad situations and it would be poor policy, as well as poor business, to ask tax-payers to protect ill-advised municipal undertakings. In the case of district heating operation, there is hardly enough fundamental economy at best in the industry to run the risk of having the proposition mismanaged by the average municipal authorities.

THE publication of the monthly weather charts for five representative American cities will be resumed in the next (December) issue. This will make the twelfth year of publication of these charts.



Carbonic Anhydride Refrigeration Plants

As has been stated, ammonia, while particularly suited to refrigeration uses, is not the only medium so employed. Successful plants and apparatus have been developed utilizing other gases among the most prominent of which are carbonic anhydride gas and compressed air.

REQUIREMENTS OF CARBONIC ANHYDRIDE PLANTS

Practical refrigeration machines employing carbonic anhydride gas are on the market, these being built and operated in a manner largely similar to the ammonia systems already described inasmuch as the gas is liquefied by the removal of its latent while under pressure in condensers; the operating pressure, however, differs materially.

In order to keep the gas in a liquid state the following pressures must be exerted, according to the temperatures in degrees Fahr.

Deg. F.	Required Pressures; Lbs. per Sq. In.
80	1000
30	500
0	311
—30	183
—80	96
—150	21
—180	0

Where the compressed gas of any refrigeration system is passed rapidly through a condenser it has been found that the temperature of the liquefied gas runs about 10° higher than the condensing water so that if the maximum water temperature is 60° to 75° F. the operating pressure on the gas must be close to 1000 lbs. per square inch. A chart

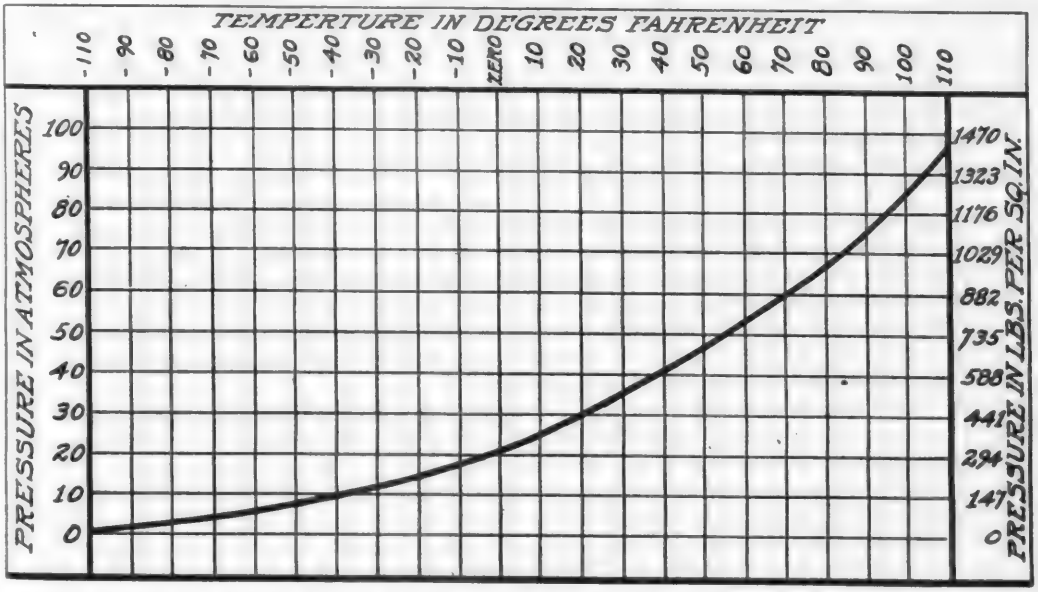


FIG. 1.—PRESSURES AND TEMPERATURES OF EVAPORATION.

covering the pressures and temperatures of vaporization is given in Fig. 1.

Not only must the machine be built very heavy to withstand such a pressure, and unusually heavy fittings used on the pipe, but, besides this, leaks are almost impossible to avoid and the diameter of the gas cylinder must be kept much smaller than the steam cylinder.

Leaks of carbonic anhydride gas are particularly dangerous as they are not noticeable by smell (as is the case with ammonia) and the gas being heavier than air sinks into cellars or other low spots, collecting at such points and rendering a person almost unconscious before its discovery is made. For this reason when this gas is used leaks are particularly dangerous and must be most carefully guarded against.

Compressors for carbonic anhydride gas are almost invariably of small size and made of the single-acting type, owing to the difficulty of keeping stuffing boxes tight under the high pressures necessary; compressors of larger size are constructed, however, for liquefying this gas for special beverages and for use in charging the familiar soda fountain. For such purposes it is liquefied and transported in steel carboys which are delivered to the various fountains. The compressors are generally compounded, the low pressure cylinders delivering the gas to a receiver at about 500 lbs. pressure; the gas is cooled in the receiver and is then compressed farther in the high-pressure cylinder up to a pressure of 1000 lbs.

The cycle of operation for a refrigeration plant operated with this gas follows along lines similar to that of the ammonia compression plant; as indicated in Fig. 2, the gas after compression passes into an oil separator where it is freed from the oil from the compressor cylinder; from the cylinder the gas passes into the condenser where it is cooled and condensed, its latent heat being absorbed by the condensing water. The liquid then flows to a receiver and from there is carried to the cooling coil through an expansion valve which allows the pressure to drop to about 40 lbs.

It is possible to use the gas directly in the cooling coils or to use the coils to cool brine which in turn is circulated to the brine refrigeration coils, thus securing better temperature control in the coils by controlling the brine temperature.

Direct expansion coolers are also built for use with the system when it is desired to do air cooling, the cooler being placed in the air washer spray chamber. Such a cooler is shown in Fig. 3.

COMPARISON OF CARBONIC ANHYDRIDE AND AMMONIA PLANTS

According to the manufacturers of carbonic machines the following is a comparison of the advantages and disadvantages between carbonic anhydride and ammonia.

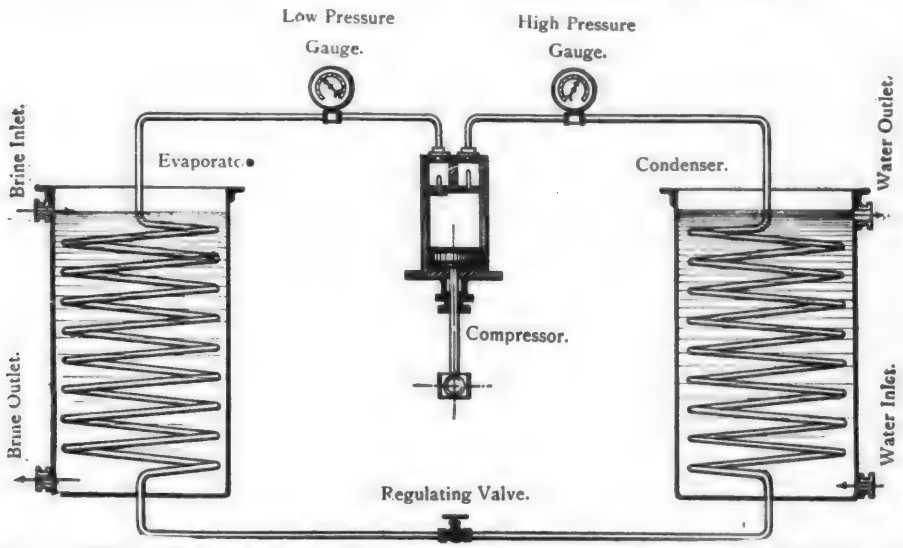


FIG. 2.—CYCLE OF OPERATION FOR A REFRIGERATION PLANT OPERATED WITH CARBON ANHYDRIDE GAS.

CARBONIC ANHYDRIDE

1. Is harmless and odorless.
2. Is a fire extinguisher; it does not unite with lubricants, cannot be disintegrated, and does not deteriorate.

3. Is neutral, does not attack metals nor food products, and is a preservative.
4. It is cheaper than ammonia.
5. The entire charge of CO_2 in a refrigerating plant could be discharged into the engine-room without any evil results whatsoever.
6. CO_2 is absolutely non-explosive and will not support combustion under any conditions, but on the contrary will retard it.
7. The actual horsepower required for CO_2 machines of capacities between 10 to 25 tons is 1.2 H. P. per ton for refrigeration with condensing water at 70° F. With larger capacities the economy in power requirements increases correspondingly.

   In this connection they refer to pratical tests made by themselves, by consulting engineers employed by them for this purpose, and by a commission of engineers appointed by the Danish Government. The results are as follows:

   No. 1—Twelve-ton plant at 1.2 H. P. per ton of refrigeration with water at 56° F. and brine at 6° F.

   No. 2—Fifty-ton plant at P. Barman Brewery, Kingston, N. Y., 1.01 H. P. per ton of refrigeration with water on condenser 53° F., off 81° F.
8. Carbonic acid machines are constructed very strong and compact without reaching the proportions of ammonia machines of the same capacity. A cylinder bore of 4⅛ in. in these machines corresponds to a bore of 9½ in. in an ammonia machine of same capacity.
9. The operation of CO_2 machines is very simple; for instance, if it is desired to inspect the inside of cylinder, it is only necessary to close the discharge and suction stop valves (both valves being mounted on the side of the cylinder) and open the machine where desired.
10. It is an acknowledged fact that the CO_2 refrigerating machine is the only one which may be installed anywhere with perfect safety. This is especially important for plants installed in hotels, stores, hospitals or any building where a number of people assemble. This also applies to ships of all kinds. This machine is provided with a safety valve which relieves the pressure, should it become excessive. The use of this valve is impossible with the NH_3 system on account of danger from the escaping gas. A substantial proof of the foregoing is the fact that with thousands of CO_2 machines in practical operation, there is not a record of a single accident in connection with same.
11. The CO_2 machine possesses the maximum economy of any compressor. One of the most important factors of this machine is the low ratio of compression which is but one to three, and consequently the re-expansion of the gas in the clearance space amounts to very little.

ANHYDROUS AMMONIA

1. Is a blood poison and possesses a very pungent, unbearable odor.
2. Is inflammable when mixed with oil. It disintegrates at a high temperature and becomes an explosive.
3. Ruins everything with which it comes in contact, either through its penetrating, suffocating odor, or its corrosive action which attacks all metals.
4. Costs more.
5. One-half per cent of ammonia in the atmosphere renders life unendurable.
6. Ammonia becomes a high explosive in case of fire, as it disintegrates at high temperature into its constituents, nitrogen and hydrogen, the latter being a combustible gas.
7. Requires 1.3 H. P. per ton of refrigeration with condensing water at 70° F. and machine capacities between ten and twenty-five tons is the best economy ordinarily reached with ammonia machines in practice. It is claimed that the theoretical efficiency of ammonia machines is greater than that of the carbonic acid machines when using condensing water of high temperature. This assertion, however, is not substantiated by practical experience. On the contrary, marine refrigerating engineers and plant owners in tropical climates who have both systems in operation, contend that the economy of the ammonia machines falls short of the economy of carbonic acid machines when using condensing water at 90° F. and above.
8. Ammonia machines of even capacities considerably exceed the carbonic acid machines in bulk; they have longer frames and require a compressor volume six times as large as the compressor volume of CO_2 machines.
9. Ammonia machines possess numerous by-pass connections and arrangements for evacuating the different parts of the system, which are controlled by a great many valves, etc., and before the machine can be opened for the inspection of stuffing-box, piston packing or the valves, it is absolutely necessary to discharge all the ammonia into the condenser, confining it there by closing all the valves leading from same to the part to be inspected.
10. Ammonia explosions occur frequently, and while it is doubtful from a strict

chemical point of view that such explosions can take place at the ordinary temperatures, the fact remains and the causes have been attributed to the presence of hydrocarbons, resulting from the decomposition of the lubricating oil.

Most of the ammonia accidents may have been caused purely by bursts, giving evidence of excess of pressure which may have been caused by water.

11. The efficiency of ammonia machines is very readily impaired by clearance space, leaky valves, etc., for the reason that the ratio of compression in the ammonia machine is high, being ordinarily one to ten and sometimes one to fifteen, and such clearance space will allow the re-expansion of the gas, and reduce the capacity of the machine.

Notes

It is claimed that electric wiring in conduits is not suitable for cold storage rooms or refrigerators owing to short-circuiting which is almost positive to occur within the compartment. It is recommended that all such wiring be made of waterproof wire, run exposed.

———:———

It has been agreed that clear artificial ice costs more than gray ice and, as the cooling effect is the same and the cost less, that clear ice is a useless and expensive requirement. Possibly this is true, yet we challenge any one to produce the effect of apparent purity and the appetitizing delight contained in a piece of clear sparkling ice.

Ice for purposes where it is used *visibly* will be *clear* for a long time to come and we believe that ice so opaque as to prevent seeing through a comparatively thin piece will never enjoy the popularity of the clear and transparent production.

———:———

Refrigeration enjoys a place in the sun and for the preservation and conserving of the food supply the cold storage warehouse is a most valuable adjunct—but as a means for the speculator to corner the market it is indeed abhorrent. There has been considerable agitation against the cold storage warehouses from time to time as evinced by the more or less frequent enactment of laws of increasing stringency relation to the length of time products may be held.

The far-sighted cold storage owners will not need to be reminded that the perversion of these plants for such purposes is not only pernicious but will not be endured under present conditions. Patriotic owners can assist the government and the country by personally preventing the use of their plants to aid such purposes.

———:———

A new helmet to protect the operators of ammonia plants when ammonia leaks cause dangerous fumes to form has been put on the market by the Protecto Safety Appliance Co., Newark, N. J. The helmet somewhat resembles the well-known smoke helmet and can be adjusted on the wearer in one-half minute. After entering a gas-filled room this helmet will protect the wearer for a period of two hours.

———:———

Kroeschell Bros. Ice Machine Co., of 472 West Erie St., Chicago, makes a specialty of carbonic anhydride plants for air cooling purposes, and also of small and compact refrigeration plants. Fig. 1 shows a self-contained refrigerating unit, the condenser and machine being mounted on a combined brine and ice tank.

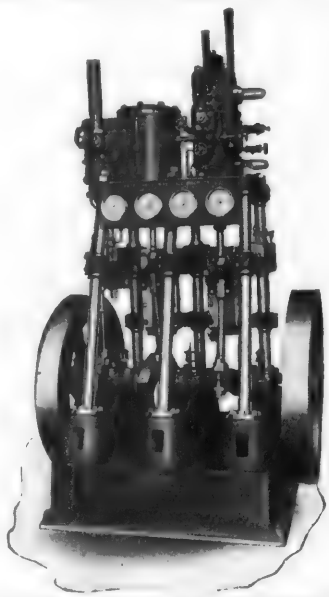
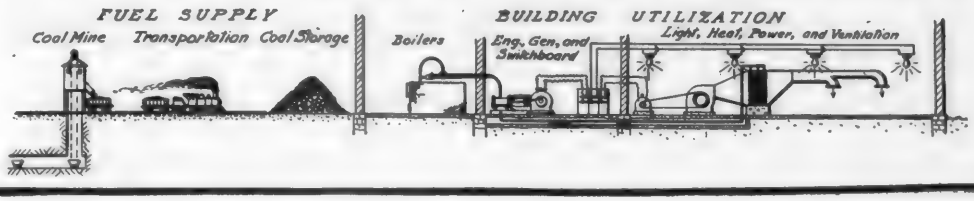


FIG. 1.—TYPE OF SELF-CONTAINED REFRIGERATING UNIT.

———:———

For refrigeration plants of small capacity the Remington Machine Co., Wilmington, Delaware, has specially suited machinery arranged for electric drive.

POWER PLANT ENGINEERING



Automatic Control For Boiler Feed Pumps

Having selected the boiler-feed pumps and determined their size, (see October issue) the piping and method of control should next be decided upon. The piping is separated into two distinct parts, these consisting of the connections for the steam end and the arrangement of suction and discharge piping on the water end.

The water connections depend a good deal on just what the pump is required to do besides strictly boiler-feed work. If used for feeding alone the common practice is to run two headers along back of the water cylinder —one being a suction header and the other a discharge header. From these headers branches are run to each pump, the suction branch being valved and usually provided with a strainer between the valve and the pump. The discharge branch is also valved, is usually provided with a check between the valve and the pump and should have a relief valve between the check and the pump.

Strainers, as the reader is aware, are for the purpose of preventing any obstructions entering the pump and getting into the valves or cylinder; they are manufactured in a variety of forms, some of the most common of which are illustrated in Fig. 1.

Relief valves should be of the hydraulic type and should be capable of taking the entire delivery of the pump, assuming that the discharge valve has accidently been left closed when the pump is started.

If the pump is to serve as an emergency pump for other lines, or if other pumps are to be cross-connected so as to serve as emergency boiler-feed pumps, an arrangement somewhat as shown in Fig. 2 can be used with advantage. In this scheme all the suction headers are run along the wall close to the floor back of the pumps and the discharge headers are carried along the same wall immediately above. Branches from each suction and discharge header are taken off at each pump and connected together, entering and leaving the pump through a common valved line.

The way this piping would be arranged in plan view is shown in the sketch, Fig. 3, but for the sake of clearness the strainers and relief valves have not been shown in either drawing; these, of course, would come on the branch into the pump and not on the separate branches from the mains.

With three pumps so connected any one pump can be used for any given service by properly manipulating the valves to handle such service.

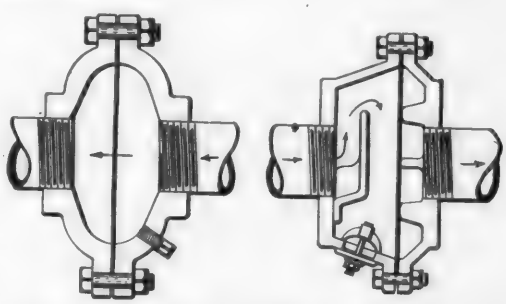


FIG. 1.—COMMON FORMS OF STRAINERS FOR BOILER-FEED PUMPS.

On the steam end more diversity with fewer pipes is practiced. This is because, while there is never anything to consider on the steam end except steam and exhaust pipes. the matter of pump control results in several methods of piping being used. The simplest form of steam and exhaust connections is shown in Fig. 4 where a steam line is carried down to the pump and the pump controlled by a globe valve. This line, however, when the pump is closed down—will fill up with water; before starting the pump the drip valve should be opened on the blow-off line and this water allowed to empty out. The exhaust is dripped, generally through a trap,

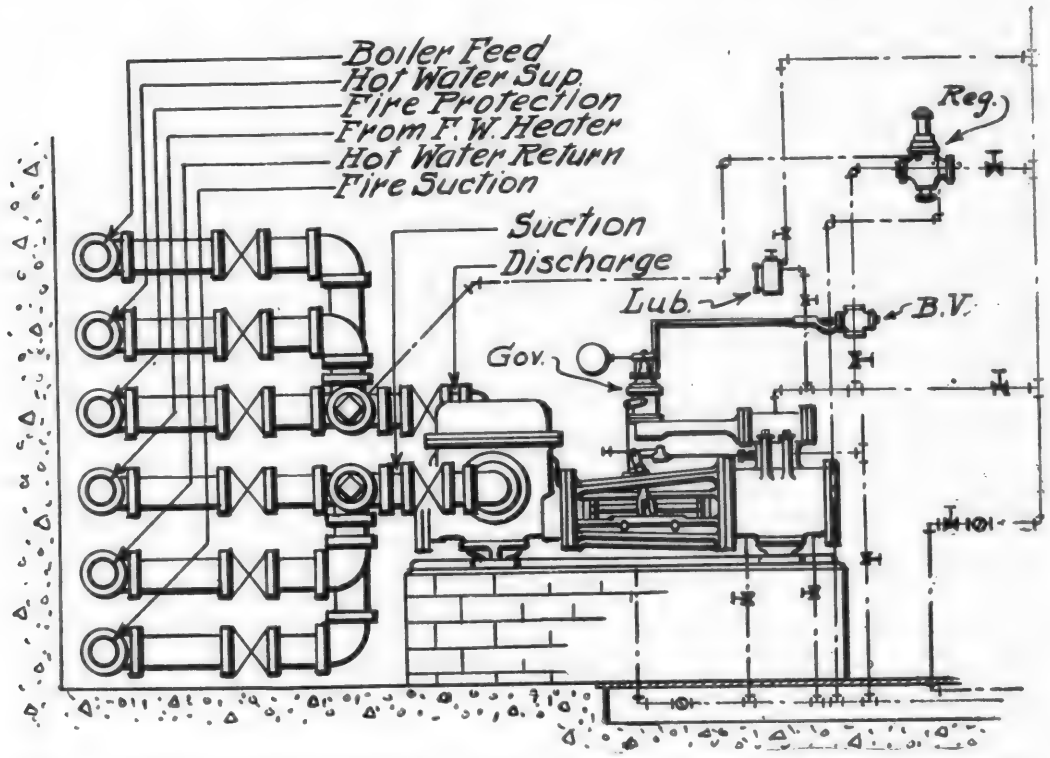


FIG. 2.—TYPICAL ARRANGEMENT OF PIPING WHERE PUMPS ARE CROSS-CONNECTED FOR EMERGENCY SERVICE.

although this, too, can be allowed to go to the blow-off tank or sewer by cracking the drip valve slightly. Such piping is entirely non-automatic and is only used where the work installed must be of the cheapest or the operation of the plant placed in charge of inferior help.

The fact should not be lost sight of that the reciprocating steam pump, to a great extent, duplicates the common steam engine as far as the steam cylinder is concerned. While the steam is not used expansively in the cylinder still cylinder drips are advisable and an endeavor to keep the steam cylinder free from water and to provide it with dry steam is quite necessary for satisfactory operation.

MAKING BOILER-FEED PUMPS AUTOMATIC

The first step in making the boiler-feed pump an automatic proposition consists of placing a trap on the high-pressure steam line so as to keep the drop free from water at all times. This is so simple that the reader is already prepared to take the next step which consists of controlling the pump from the discharge pipe pressure by a pump regulator placed in the steam line supplying the pump. Most of such regulators are constructed on the principal of having a small pipe (connected to the discharge line of the pump) carried up and connected to a chamber located on one side of a diaphragm. On the other side of the diaphragm is placed another

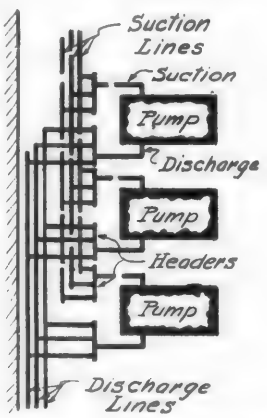


FIG. 3.—PLAN OF PIPING SHOWN IN FIG 2.

chamber connected by a pipe to the steam supply.

Thus the diaphragm is separating two opposing forces and, as the steam pressure is

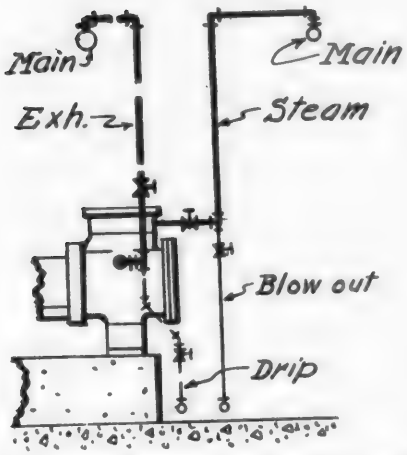


FIG. 4.—SIMPLE FORM OF STEAM AND EXHAUST CONNECTIONS.

always lower than the pressure required to feed in the water against it, the diaphragm on the steam side is assisted by the addition of a spring of sufficient force not only to counteract the difference in pressure, but which can also be adjusted so as to hold any desired higher pressure on the water side.

The installation of such a regulator is indicated with dot and dash lines in Fig. 2 while an enlarged detail of the steam and exhaust connections is shown in Fig. 5, the location of the regulator (Reg.) being in the steam line to the pump. The lubricator (Lub.) is set in a steam pipe by-pass so as to be shut off independently of the other equipment.

To control the pump so that it will not exceed a given speed and to prevent its racing or slamming, should the pressure ever be released suddenly on the discharge line, a governor (Gov.) is used, this governor being connected to the piston and shutting down the steam supply through the rods connected with the balanced valve (B.V.) which acts regardless of the control supplied by the regulator. In other words, the regulator starts and stops the pump but the governor determines the speed of operation after the pump has been started. It must be understood, however, that this sort of control is only partially automatic. That is to say, the

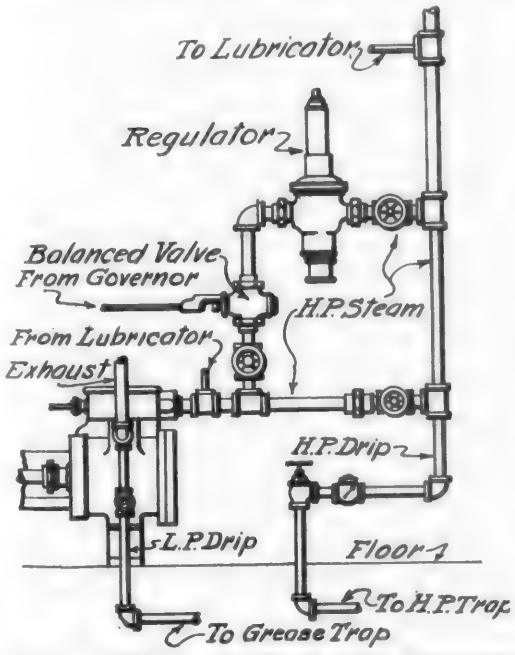


FIG. 5.—DETAIL OF STEAM AND EXHAUST CONNECTIONS FOR BOILER-FEED PUMP.

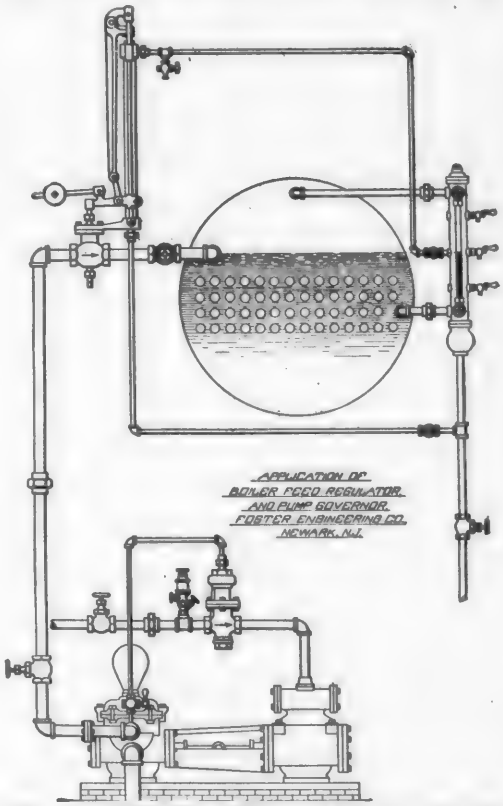


FIG. 6.—DEVICE FOR MAKING BOILER FEEDING AUTOMATIC.

pump maintains any certain pressure on the line but does not feed the boiler, the actual feeding being controlled by hand-operated valves manipulated by the fireman.

There is still another device which makes the boiler feeding positively automatic. This is illustrated in Fig. 6, the detail of the operating mechanism being shown in Fig. 7. With this apparatus the controller is set at any convenient point and the pipe to the controller is tapped into the water column at the height it is desired to maintain in the

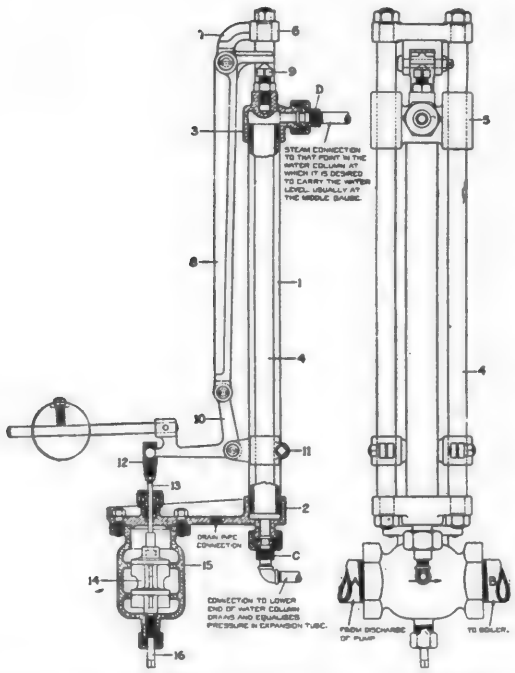

STEAM CONNECTION TO THAT POINT IN THE WATER COLUMN AT WHICH IT IS DESIRED TO CARRY THE WATER LEVEL, USUALLY AT THE MIDDLE GAUGE.
DRAIN PIPE CONNECTION
CONNECTION TO LOWER END OF WATER COLUMN DRAINS AND EQUALIZES PRESSURE IN EXPANSION TUBE.
FROM DISCHARGE OF PUMP
TO BOILER.

FIG. 7.—CONSTRUCTION OF AUTOMATIC BOILER FEEDING DEVICE.

water line. When the water line falls below this point, steam enters the pipe but when it rises above the proper level it seals the pipe and prevents steam getting to the controller.

When the water in the boiler or water column seals the end of the pipe leading to the top of the expansion tube, so that steam is excluded therefrom, the tube cools and contracts. In this condition of the expansion tube the long arm of the bell crack lever "8" is free to swing outward from the expansion tube and allows the weight to depress the arm of the lower bell crank "10," so as to slide valve "14" downward into closed position, cutting off and preventing water from entering the boiler through the feed line.

When the water recedes below the predetermined boiler level it uncovers the opening in the pipe leading from the water column to the top of the expansion tube and permits steam to enter the same. This heats and expands tube (Figure 1) carrying the adjusting screw "9," which can be set for and desired variation, upward against the short arm of bell crank lever "8," thus swinging the long arm of the latter inwards or towards the expansion tube. This carries the lower bell crank lever "10" and raises the weight, drawing valve "14" upward, opening the main feed valve, permitting water to flow through the feed pipe into the boiler. The flow continues until steam is again cut off from the expansion tube "1," allowing the contraction of the latter sufficiently to close valve "14."

Notes

The Harrison Safety Boiler Co., Philadelphia, Pa., has perfected a new type of open-feed water-heater which is known as a "steam-stack and cut-out valve heater." The heater, which embodies all the good features of the old Cochrane heaters, has, in addition, an extra large oil separator, a three-way valve so that the exhaust steam may be directed entirely into the heater, entirely to the atmosphere or any graduation between the

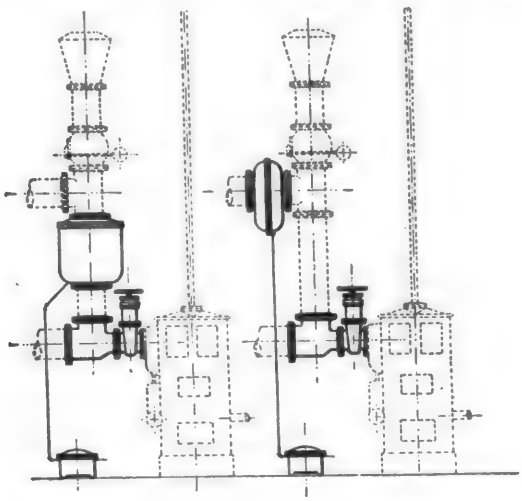


FIG. 1.

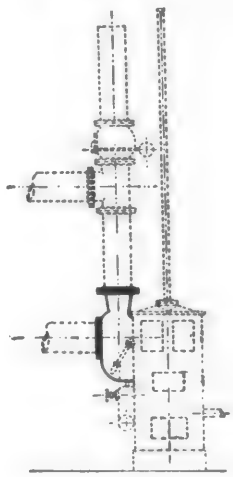


FIG. 2.

FIG. 3.

NEW TYPE OF OPEN-FEED WATER HEATER.

two. This heater eliminates considerable cost in fittings, valves, oil separators and trap as can be seen by reference to Figs. 1, 2 and 3. Figs. 1 and 2 are two standard methods of connecting the old style of heater and Fig. 3 the method used with the steam-stack heater. It is claimed that the cost of fittings and labor thus saved will pay 70% of the cost of the heater.

The Gardner Governor Co., Quincy, Ill., has made a large assortment of apparatus for over fifty years. Their line embraces air compressors, duplex steam pumps, steam and oil separators, engine governors, etc.

The Standard Steam Specialty Co., New York, is the manufacturer of the Utility exhaust head which is designed on the condenser principle, with air circulating tubes and a series of deflector plates so that only dry steam is allowed to escape.

The War and the Heating Engineer

Heating Men in Military Service.

Don R. Marsh, production manager of the Buffalo Forge Co., Buffalo, N. Y., has given up his work to assume similar duties at Washington in the production of ammunition. Mr. Marsh will receive a captain's commission. Charles C. Cheyney, manager of the company's Chicago office, has been given a commission in the Naval Aeronautic Corps and is beach engineer at Pensacola, in charge of aeroplane engines. C. F. Goodrich, assistant manager of the company's Boston office, has left for active duty as first lieutenant in the Ordnance Department. He is stationed at Watervliet Arsenal.

J. C. Latimer and Allen B. Stiles, of Crane Co., Chicago, have received commissions as second lieutenants in the National Army and are stationed at Camp Grant, Rockford, Ill. Lieut. Stiles is the son of R. B. Stiles, assistant treasurer of Crane Company and Lieut. Latimer was formerly connected with the company's engineering department.

Captain C. G. Denison, formerly assistant credit manager of the American Radiator Co., is now stationed at Camp Grant, Rockford, Ill. Joseph S. Barker, Alexander T. Burr and C. S. Gardner, of the same company, who entered the service, are now in France.

Albert W. Hills, formerly western manager of the Haydenville Co., Haydenville, Mass., who has been serving with the scout patrol on the Atlantic coast, suffered a fracture of the arm recently. He is recuperating at the Navy Hospital.

Paul Wagenseller, son of C. N. Wagenseller, manager of the advertising department of the H. Mueller Mfg. Co., Decatur, Ill., has been given a commission as second lieutenant in the Reserve Officers' Training Camp at Fort Sheridan and is now on duty at Camp Grant, Rockford, Ill. Two other sons of Mr. Wagenseller are also in the service, Dean being a private at Camp Grant, and Kirk Wagenseller, in the signal corps on board the U. S. S. Michigan.

William Boyd, son of Charles J. Boyd, a former president of the National Association of Master Plumbers, is serving in the Quartermaster's Department of the National Army, with the rank of corporal.

Among the members of The American Society of Heating and Ventilating Engineers who are on active duty are R. S. Bull, of Chicago, who is a lieutenant at Camp Grant; Ben Nelson, who is at the officers' training camp at Fortress Monroe; C. C. Cheyney, of Chicago, who is an ensign in the aviation department of the navy, on duty at Pensacola, Fla.; and L. C. Monroe, who is stationed at Camp Grant.

W. M. Pattison, president of the W. M. Pattison Supply Co., Cleveland, O., has been commissioned major in charge of supplies of the Quartermaster's Department.

H. S. Haley, member of the firm of Leland and Haley, consulting mechanical and electrical engineers, San Francisco, Cal., is at present at the Llewellyn Iron Works, Los Angeles, Cal., in the interest of the United States Shipping Board Emergency Fleet Corporation, on one of the largest marine boiler contracts placed on the Pacific Coast.

Men Needed for Quartermaster's Enlisted Reserve Corps.

The Quartermaster's Enlisted Reserve Corps, with recruiting headquarters at 357 Broadway, New York, has received a new authorization to enlist men to follow ther civilian trades in the army, for duty in this

country and abroad. The men particularly needed at this time are electricians, tinsmiths, iron workers, carpenters, plumbers, mechanics (auto), mechanics (general), masons, bricklayers, farriers, horse-shoers, saddlers, blacksmiths, teamsters, cooks, chauffeurs, stenographers and wagemasters. Those enlisting must be between the ages of 18 and 45 years and have no one depending on them for support. Military training as a soldier is not required in this branch of the service. Those in the drafted list may qualify for this service.

Securing Stenographers for the Ordnance Department.

J. Irvine Lyle, secretary and manager of the Carrier Engineering Corporation, New York, has been appointed chairman of a committee to enlarge the personnel of the Gun Divsion of the Ordnance Department, in Washington. Mr. Lyle's appointment was made by Major-General William Crozier, chief of ordnance, and the committee's work will be devoted more particularly to the securing of some 500 additional stenographers for the gun division. An equal number of draftsmen is required by the gun division and another committee is engaged in securing these men.

Government Orders.

Farnsworth Co., Conshohocken, Pa., reports a U. S. government army engineers' order for fourteen 2½-in. Farnsworth duplex boiler feeders for camps, each machine being capable of feeding 750 h.p. of boilers. They feed water into the boilers at a temperature of over 300° F. with a saving in coal of 10% for every 100° difference.

The New Food Pledge.

A new form of food pledge for men and all those not directly in charge of a household has been adopted by the United States Food Administration and was the basis of a national campaign during the week beginning October 28, when every resource of publicity and organization was enlisted to secure signatures to the food pledge all over the United States. The form is given herewith. Any of our readers who have not already signed this pledge may use the accompanying form which should be signed, clipped and sent to the United States Food Administrator in your State or to the Food Administration, Washington, D. C.

To the United States Food Administration:

I pledge myself to use the practical means within my power to aid the Food Administration in its efforts to conserve the food supplies of the country, and, as evidence of my support, I wish to be enrolled with yourselves as a volunteer member of the Food Administration.

Name .....
Street .....
City .....State .....

There are no fees or dues. We want your help, in the form both of your personal efforts to economize food and your influence with others toward food economy and wise control of our national supply. If you will give this help it will be a direct service to your country.

As member of the United States Food Administration you can directly aid the Food Administration and help win the war by: (1) Eating as little wheat bread or other wheat products as circumstances permit, and, if possible, not more than once daily; (2) eating meat (beef, mutton, or pork) not oftener than once a day; (3) economizing in the use of butter and discouraging the excessive use of other fats; (4) cutting your daily allowance of sugar in tea or coffee, and of sweet drinks, candy, and in other ways helping to lessen the consumption of sugar; (5) eating more corn, rye, vegetables, fruit, fish, and poultry in place of wheat and meat; (6) avoiding waste of all kinds; and (7) urging in your own home or the restaurants you frequent the necessity of economy in food, and requesting the observance of these pledges by other persons.

Our problem is to feed our allies this winter by sending them as much food as we can of the most concentrated nutritive value in the least shipping space. These foods are wheat, beef, pork, dairy products, and sugar.

Our solution is to eat less of these and more of other foods of which we have an abundance, and to waste less of all foods.

Ordnance Corps in Need of Skilled Men.

Skilled men in many lines of trade are urgently needed in the Enlisted Ordnance Corps of the National Army, according to a communication sent out through the office of the chief of ordnance. This corps, into which the Ordnance Enlisted Reserve

Corps has been merged, is charged with the supply, maintenance and repair of all cannon and artillery vehicles and equipment, all machines for the service and manouver of artillery; in fact, it is the army known as "service of the rear." There is a place for practically every man who knows a trade in this corps. Machinists, mechanics, plumbers, etc., are especially needed at this time. Those accepted for enlistment will ultimately see service abroad. Application blanks may be had from Chief of Ordnance, Enlisted Personnel Division, Washington, D. C.

Government Still in Urgent Need of Stenographers and Typewriters.

The United States Civil Service Commission is calling fresh attention to the war need of the government for stenographers and typewriters. Women especially are urged to undertake this office work. Examinations for the department are held every Tuesday in 450 of the principal cities of the United States and applications may be filed with the commission at Washington at any time. The entrance salary ranges from $1,000 to $1,200 a year. Applicants must have reached their eighteenth birthday on the date of the examination. Full information in regard to the scope and character of the examination and for application blanks address the U. S. Civil Service Commission, Washington, D. C., or the secretary of the U. S. Civil Service Board of Examiners in Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle, San Francisco, Honolulu, or San Juan, Porto Rico.

War Service Committees Being Organized in Various Industries.

To bring about an immediate action by American business on the resolution passed at the recent war convention in Atlantic City, recommending that each industry from a committee to represent that industry and to serve as a connecting link between it and the government, a committee of the Chamber of Commerce of the United States suggests, among other things, that all branches of each industry be represented on the committee, whether members of a trade organization or not; also that the committee should include representatives of some of the smaller units of the industry, as well as the larger; and that sub-committees of the important branches of the industry be appointed to cooperate with the war service committee wherever possible.

Many lines of industry, it is pointed out, are seriously affected by inability to get necessary material or labor and face serious problems for the future in connection with the shifting of labor from one community to another. Furthermore, the government, to procure war materials and supplies in the vast quantities required, needs the advice and assistance of men having thorough acquaintance with each industry. Also, the government is confronted with great problems in connection with the regulation of prices and distribution and to avoid unnecessary interference with business, and needs at its service the practical knowledge and experience which could be furnished by such committees.

War service committees might undertake the following:

1. To assemble accurate information with respect to the facilities of the industry, the possibilities of expansion or the readjustment of plants and equipment to meet the ever increasing requirements of the government.

2. To arrange for the gathering of figures as to cost of production in the industry including conditions which were changing the cost of production. In this respect the committee would furnish to the government information which would prevent avoidable hardship in the business by government regulation of prices or distribution.

3. To act with the Priority Committee of the War Industries Board which is establishing principles governing the distribution of materials in transportaton and the order in which various products are to be produced and distributed.

4. New facilities are being created and there is great shifting of labor from one section of the country to another. War service committees could offer suggestions regarding the use of existing facilities or the employment of labor in districts of the country where needed after the war.

5. These committees should be ready at all times to meet with any of the Departments of the Government whenever their advice is desired, to discuss questions affecting the industry raised by the war needs of the government.

The appointment of a war service committee to represent the heating and ventilating trade has already been made by President J. Irvine Lyle of the American Society of Heating and Ventilating Engineers.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Officers Nominated for 1918.

The following nominations have been made by the nominating committee of the American Society of Heating and Ventilating Engineers, Frank T. Chapman, chairman:

For president, Frederick R. Still, Detroit, Mich.; for first vice-president, Walter S. Timmis, New York City; second vice-president, E. Vernon Hill, Chicago; treasurer, Homer Addams, New York City; Council, J. Irvine Lyle, New York City; W. H. Driscoll, New York City; Howard H. Fielding, Denver; H. P. Gant, Philadelphia; Charles W. Kimball, Boston; Frank G. Phegley, Cleveland; Fred W. Powers, Chicago; and Champlain L. Riley, New York City.

Secretary C. W. Obert, who is also secretary of the Boiler Code Committee of The American Society of Mechanical Engineers, recently visited a number of mid-western cities in the interest of the boiler code and incidentally called on members of the heating engineers' society in Columbus, Detroit, Indianapolis, St. Louis, Kansas City, Chicago and Toronto. He also attended the convention of the stationery engineers in Evansville.

Committee to Report on Health Conditions in Workshops.

In response to a request from Samuel Gompers, head of the committee on labor of the National Council of Defense, that a representative from the heating engineers from each State be appointed to join with a sub-committee of the council, President J. I. Lyle has named Jay R. McColl, dean of engineering in the University of Detroit, to act as Michigan's representative.

The joint committee will be composed of representatives of scientific and engineering bodies. Its chief aim will be to conserve the efforts of wage earners during the war.

Committee to Confer with National District Heating Association.

The council of the heating engineers' society has appointed the following committee to confer with a similar committee representing the National District Heating Association, having for its object a closer co-operation between the two organizations: J. Irvine Lyle, chairman; A. S. Armagnac, W. H. Driscoll, C. W. Obert and Frederick R. Still. The National District Heating Association will be represented by President George W. Martin and Secretary D. L. Gaskill.

Eastern Pennsylvania Chapter.

The Eastern Pennsylvania Chapter devoted its first meeting of the season to a discussion of "Coal Conservation." Secretary George Boon has sent out a year book of the chapter, containing the names and addresses of the members, and including a history of the chapter, together with its constitution and by-laws.

Kansas City Chapter.

The Kansas City Chapter held its first meeting of the season September 14, when Secretary C. W. Obert was in Kansas City. Mr. Obert addressed the chapter, giving an account of the work being done for the government by members of the society. F. A. DeBoos also spoke, his remarks including a review of the society's recent summer meeting in Chicago. President H. W. Whitten presided.

The annual meeting of the chapter was held at the University Club, Kansas City, October 5, when the following officers were elected: President F. A. DeBoos, formerly secretary of the chapter; vice-president, Walter E. Gillham; secretary, John H. Kitchen; treasurer, T. J. McMorran. Members of the council B. J. Natkin (chairman), William M. McIntyre and John B. Pease.

A paper was presented by D. T. Taylor on "Estimating the Cost of Heating Buildings." Fifteen new members were elected, making a total for the Kansas City Chapter of 41 members. The programme committee is at work on the subjects to be considered at each meeting for the year. Special committees will be in charge of each meeting.

Michigan Chapter Elects Officers.

The first regular meeting of the Michigan Chapter for the season was held October 8 at the Fellowcraft Club, following a chapter dinner. The principal speaker was Lieutenant Samuel Eckert of the Selfridge Aviation Corps at Mount Clemens, Mich., who

told of the extensive preparations being made at Mount Clemens for training and equipping the aviation service.

New York Chapter Addressed by Army and Navy Officers.

Some of the wonders of the huge army cantonments were presented at the opening meeting of the New York Chapter, which was held at the Building Trades Club, October 15. The meeting was preceded by the usual chapter dinner, the guests of honor being Major O. K. Myers, construction quartermaster of Camp Upton, at Yaphank, L. I., Captain L. H. Tripp, of the Quartermaster's Department in Washington, and Commander Harris of the U. S. S. Maine.

At the conclusion of the dinner President Frank K. Chew addressed the members, calling attention to the programme for the year which had been prepared. He then turned over the meeting to Walter S. Timmis, chairman for the meeting. Mr. Timmis referred briefly to the mechanical equipment for Camp Upton which was designed by him and presented Major Myers who spoke on the difficulties and the plan and scope of the work at Camp Upton. He said that in addition to the regular sixteen army cantonments for the draft army there are eighteen additional encampments for the National Guard of the various States and in connection with the embarkation stations.

ENTIRE CAMP BUILT IN SIXTY DAYS.

At Camp Upton, where there 'are now 1,200 acres of buildings, the work of clearing the ground was not begun until July 5. In handling the construction work, three methods were possible: to consult with engineers, to deal with engineers who had an organization and, third, a combination of the two. The third plan was adopted. Typical plans of the various buildings were used and the contractors' work divided into purchasing, tracing, accounting and construction departments.

As giving some idea of the extent of the cantonment, Major Myers said that 3½ miles of wood stave pipe were used for carrying water this pipe being 8 in. and over. Eighteen miles of iron and steel pipe under 8 in. were installed. In addition to the 1,200 acres already in use, 2,000 acres additional will be cleared for drill purposes. An immense central heating plant is installed for the hospital group of buildings, while the officers' quarters are separately heated by individual steam heating plants and the barracks themselves have stoves. The refrigerating plant is of 20-ton capacity, while the laundry is one of the largest in the United States.

At one time 14,000 men were employed in the construction of the camp. This number constantly varied owing largely to the pest of mosquitoes which often made sleep impossible.

WORK OF QUARTERMASTER'S DEPARTMENT.

The next speaker, Captain Lewis H. Tripp, told of the work of the Quartermaster's Department in Washington in getting out the first plans for the cantonments which served as a general standard. He said, among other things, that hot water was furnished only for showers, this having the effect of forcing the men to bathe frequently. There are 30 kitchens in each cantonment and 9,000 ranges for the sixteen cantonments. The bakeries are in continuous operation and turn out 18 tons of bread every 24 hours. He admitted that as a general proposition steam heating would have been favored above furnace heat, but that the element of time was necessarily the deciding factor.

In running the steam pipe lines, it was found in many cases cheaper to run the pipes overhead, suspended on telegraph poles instead of underground. They were covered with 1-in. air cell covering over which was placed a layer of 1-in. hair felt, the whole being enclosed in water-proof roofing paper bound on with twine.

The typical barrack buildings are 43 ft. wide by 140 ft. long, with three dormitories, each 40 x 50 ft., and a mess room 40 x 50 ft. In figuring the heat losses the coefficients used were 0.25 B.T.U. for walls and ceilings, 0.3 for floors which were lined with building paper, 1 for glass and 2.4 for each lineal foot of crack. These allowances were figured to heat the barracks to 60° F. in extreme weather. For the ventilation, it was figured that 400 B.T.U. per hour would be given off by each man and allowing 1,600 cu. ft. per hour per man would result, it was estimated, in maintaining a temperature of 50°. Coal used was estimated at 12,000 B.T.U. per pound.

For those interested in figures he stated that nearly 1,000,000 ft. of stove pipe had been used in the various cantonments, 1,700 castiron boilers with a total capacity of 3,200,000 sq. ft. of radiating surface, 265 steel boilers aggregating 3,160,000 sq. ft. of radiating surface and 3,000,000 ft. of steam and water piping.

There is a base hospital at every cantonment containing from 600 to 1,000 beds. These buildings are provided with low pressure steam for heating, high pressure steam for sterilizers, etc., a hot water circulating main and hot water heaters heated with live steam.

W. H. Driscoll, of the Thompson-Starrett Company, which has the power and heating contract at Camp Upton, then spoke, and gave a vivid account of the almost insurmountable difficulties encountered in the course of the work, which was under his direct supervision. He referred to the spirit of the drafted men as being remarkably fine.

The next speaker was Commander Harris. He said the navy was about to undergo a new experience in wintering in northern, rather than in southern waters, and that the heating accommodations would undergo a test decidedly different from anything previously experienced.

The concluding speaker was President J. I. Lyle who told of the urgent need of the gun division of the ordnance department, in Washington, for 300 draftsmen and 400 stenographers. The design of trench ammunition, he said, is in constant need of redesigning due to the changes in methods and it is necessary to have a large force of designers to keep up with these changes.

The November meeting will be in charge of a committee headed by Conway Kiewitz. The chairmen for the subsequent meetings are as follows: December, W. F. Goodnow; January (annual meeting of the society) H. G. Issertell; February, W. L. Fleisher; March, C. E. Scott; April, Frank T. Chapman; and May, B. K. Strader.

New Officers for Illinois Chapter.

New officers were elected as follows at the opening meeting of the Illinois Chapter, held October 8 at the Engineers' Club, Chicago: President, Dr. E. Vernon Hill; first vice-president, G. W. Hubbard; secretary, A. E. Stacey; treasurer, August Kehm, Members of the council: Dr. E. Vernon Hill, Fred W. Powers, J. F. Tuttle, G. W. Hubbard and George Mehring.

The retiring president, Fred. W. Powers, expressed his appreciation of the support accorded him during his term of office and especially in connection with the summer meeting of the society in Chicago last July. A rising vote of thanks was given the officers.

It was announced that the chapter now has 97 members. The report of the auditing committee showed the chapter to be in a healthy financial condition.

It was voted to remit the dues of all members who are on war service.

Suggestions of topics for future meetings included "The Heating of Army Cantonments," and "Proper Methods of Testing Ventilating Installations." The new president, Dr. Hill, urged the members to contribute more papers for the society's meetings. Harry M. Hart gave an interesting account of the heating equipment at the Great Lakes Naval Training Station at Waukegan, Ill., which was installed by the L. H. Prentice Co., Mr. Hart being in direct charge of the work. (A brief account of this installation was published in last month's issue). George Mehring followed Mr. Hart with a description of the heating for the barracks at the same point.

Upon motion by J. F. Tuttle, it was voted to appoint a committe to determine certain standards for methods and apparatus in heating and ventilating work. A motion was then made by F. W. Powers and carried that a committee be appointed to report at the next meeting concerning the feasibility of creating a fund for test work in connection with the proposed standardization of methods and apparatus.

Institution of Heating and Ventilating Engineers.

In spite of the fact that England is engrossed in the war, the Institution of Heating and Ventilating Engineers is proceeding with the research plan that has been carried on at University College. This work was started by a grant from the London City Council of £300. The Government Department for Scientific Research has now proposed to make a grant of £225 per year for the next two years, on condition that the institute contribute a further sum of at least £150 and that the total amount of £600 should be expended during the two years on certain stipulated work. This offer the council of the institution has accepted, and is now appealing for further funds from its membership.

The research work in question consists largely in securing data from tests for establishing what are to be known as "British" standard co-efficients of heat losses through building materials.

American Association of Engineers.

Secretary A. H. Krom, of the American Association of Engineers, whose headquarters are at 29 South La Salle Street, Chicago, has recently completed a tour of eastern cities to interest local engineering clubs and societies in a plan for national

affiliation. The idea is to develop a national organized effort to promote business for the engineers and in this connection to handle the problems of national distribution of engineering service and national publicity.

Plan for Interesting Men in Technical Meetings.

In order to provide the kind of meetings desired by its members, the New York Section of the American Society of Mechanical Engineers is asking its members to indicate, on a return postal card, the character of papers desired and the carrying out of certain social features. Under "Character of Papers" are given "popular," "military," and "semi-technical." For those who desire technical papers space is left to indicate "what subjects." The members are also asked to state whether they prefer the get-together dinner at some hotel before the meeting, as practiced for the past two years, or whether a light supper, served in the Engineering Societies Building at nominal cost, would better solve the acquaintanceship problem.

CORRESPONDENCE

Use of Kerosene Oil for Steam Boilers.

EDITOR, HEATING AND VENTILATING MAGAZINE:

Do you know of a steaming system where kerosene oil is used for fuel? I am in need of something to cook jellies and syrups without using wood for fuel. The Department of Commerce at Washington has referred me to you.

F. B. NORDMAN, JR.

Ormond Beach, Fla.

The use of kerosene oil as a fuel for steam boilers is rather unusual, owing to the fact that wherever it is possible to obtain kerosene it is also usually possible to obtain other fuels with cheaper and more satisfactory nature. It is assumed that our correspondent will require for cooking jellies, etc., steam between 40 and 60 lbs. pressure for which purpose we can refer him to at least one manufacturer who builds boilers for kerosene.

These boilers are made anywhere from one to forty horsepower. The boiler is arranged with a gas burner, but a kerosene burner can be substituted, if desired. Even the manufacturer, however, is not very enthusiastic about kerosene as he points out that he has practically discontinued the manufacture of such boilers, now building gas-fired boilers almost exclusively. He also states that the kerosene boiler is quite efficient but not as convenient to use as the gas-fired boiler, requiring more attention; if gas rates are close to the average the kerosene boiler would possibly be more economical.

The kerosene burner is, therefore, perfectly practical, but may affect the insurance rates, while a gas-fired boiler will not cause any such increase. The pounds of water evaporated per pound of fuel burned will vary with the size and type of boiler. We would advise our correspondent to use either a coal or gas-fired boiler or to substitute crude oil for kerosene as a fuel.

Ventilating Equipment of the Brooklyn Trust Building.

In the building of the Brooklyn Trust Company at 177 Montague Street, Brooklyn, forced ventilation is supplied throughout by motor-driven fans. The main supply fan has a capacity of 18,000 cu. ft. per minute at 295 r.p.m. and is driven by a 12.5 h.p. motor. It cares for the banking room and corridors on the first floor and the directors' room on the second. The main exhaust fan is driven by a 7.5 h.p. motor; it has a capacity of 11,000 cu. ft. per minute at 268 r.p.m. This takes care of all floors. An additional fan for the basement has capacity of 11,000 cu. ft. per minute at 300 r.p.m.; it is driven by a 5 h.p. motor. The speeds of all these motors can be adjusted by resistances in the armature and field circuits.

There are two smaller blower units—

MAIN SUPPLY FAN FOR BROOKLYN TRUST BUILDING.

MAIN EXHAUST FAN, BROOKLYN TRUST BUILDING.

one of 4,000 cu. ft. per minute capacity for the boiler room exhaust and one of 6,000 cu. ft. for the toilet room exhaust. These are driven by 1 and 3 h.p. motors respectively. The main exhaust discharges into the boiler room, supplying in winter warm air for the furnaces.

All motors are for direct current of Westinghouse make. The fans are of the Sirocco type. The heating and ventilating installation was engineered by Almiral & Co., New York.

The First Heine Boiler.

After a fire which destroyed the National Guard Armory in St. Louis, Mo., a few months ago, the Heine Safety Boiler Co., of that city obtained possession of the first Heine boiler ever built, which was installed at the armory in 1881. This little boiler is shown in Fig. 1, just as it was removed.

It has 24 tubes about 10 ft. long the heating surface is approximately 250 sq. ft., making the rating of the unit 25 h.p. The boiler was built in the shop of Richard Garstang, St. Louis. The original pressure for which it was designed was about 100 lbs. and an inspection certificate from the Fidelity & Casualty Co. has been received to the effect that they will certify this boiler to carry 80 lbs. pressure at the present time.

This indicates a somewhat longer life for water-tube boilers than is usually credited them by accountants or engineers when apportioning depreciation changes. However, under modern conditions the heavier loads on boilers would perhaps tend to lessen their life as compared to this little boiler. One odd feature is the casting which forms both the steam outlet and the water column. Another obsolete feature of this boiler is the vertical baffling which was discarded in later designs for the horizontal baffling, now the standard with Heine boilers of both the land and marine types.

FIRST HEINE BOILER EVER BUILT, TAKEN FROM ST. LOUIS BUILDING.

Credit Association of the Building Trades Formed in Philadelphia.

After many years of effort, Philadelphia has at last taken equal rank with the building industry of other large cities in the formation of an organization which will be known as the Credit Association of the Building Trades of Philadelphia. One of the association's objects is "to encourage trade, receive and supply to the members information as to commerce, exchange, credits, markets; to compose differences, to collect debts and in all lawful ways to conserve and advance the business interests of its members." The board of directors is composed of representatives of the various building trade sections and permanent officers have been elected as follows: President, A. D. Weber; treasurer, William P.

Thompson; secretary, M. G. Sellers, who is also secretary of the local master steam fitters' organization in Philadelphia; executive committee: A. D. Weber, mill work; William P. Thompson, steam fitting; R. C. Williams, Jr., electric work; E. P. Henry, tile; H. W. Geshwind, cement and asphalt. Officers and headquarters have been established at 1518 Sansom Street, Philadelphia.

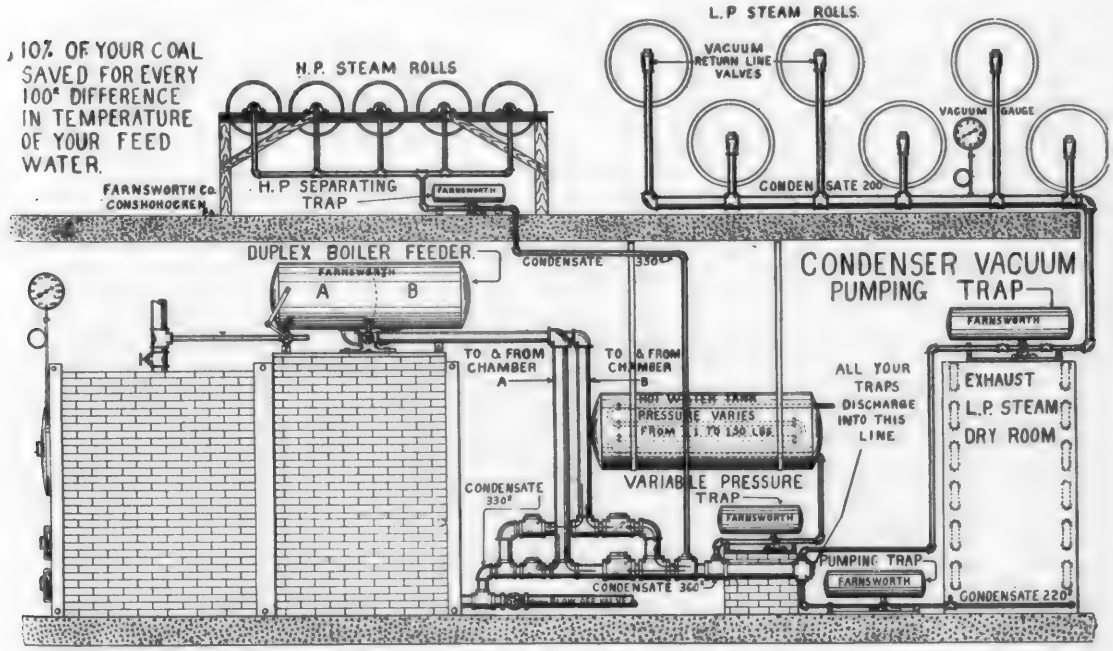
Typical Arrangement of Boiler Feeder Apparatus.

A design showing the several types of Farnsworth machines for handling the conditions involved in the average power and heating plant, without relation to specific types of apparatus, machine or general piping design, is shown in the accompanying illustration. It brings out, among other things, the temperature of the condensate under the various conditions as applied to those usually existing in this kind of a job, and particularly the temperatures of the condensate under the different stages before passing into the boiler, and how it is kept under full pressure and fed with a continuous flow directly into the boiler. The separating trap, it will be noted, collects condensate from the high-pressure rolls or from any other source under full boiler pressure and discharges its contents at 350° or over, direct into the general return line. The condenser vacuum trap collects condensate from low-pressure steam rolls under a vacuum, with a temperature of condensate at 200°, and pumps it into the general return lines. The pumping trap collects condensate from the coils in the low-pressure drying rooms at a temperature of 220° and pumps it into the general return line. The variable pressure pumping trap collects condensate from the hot water tank at a pressure of from 1 to 150 lbs. All the other types of high-pressure traps discharge into the same general return line.

The condensate from all of the traps is pumped under full pressure through the two inlet check valves leading to the boiler feeder and is delivered into either chamber A or chamber B of the boiler feeder. Chamber A fills and tilting to the left, operates the control valve and applies steam direct from the main steam line to the top of the water in chamber A which forces the condensate direct into the boiler through its delivery check valve. The admission of the steam into chamber A also preheats it to a certain extent.

While chamber A is delivering condensate at a preheated temperature of 330°, chamber B is receiving condensate from the general return line at about 300°, or at temperatures depending on volume from any particular source.

Among the points emphasized by the

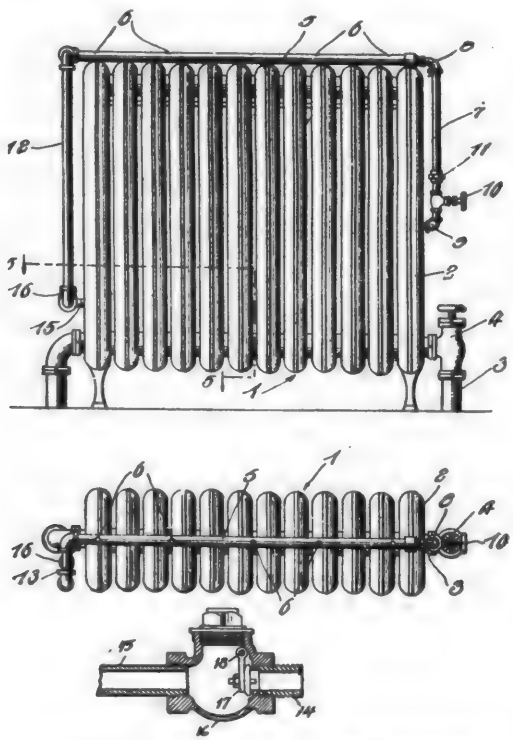


TYPES OF FARNSWORTH MACHINES AS INSTALLED IN TYPICAL POWER PLANT.

manufacturers in the construction of these specialties are that they are built without trunnions, as the load of the tank is carried on a steel shaft, thus eliminating the load from the packed swing joints; that Tuxedo swing joints are used which are drop-tight at all times; that all machines are built extra heavy; and that Monel metal valves are used on pressures above 125 lbs.

The Monahan Humidifier.

An interesting type of radiator humidifier has been patented by M. C. Monahan, of Dixon, Ill. It is intended to be applied to a steam radiator for ejecting a portion of the steam therefrom into the room. Referring to the accompanying illustration, the radiator is of the conventional type, being provided at the inlet end with a steam inlet having a cut-off valve (4). Extending along the top of the radiator and projecting a short distance beyond the opposite ends is a perforated pipe having spaced perforations disposed longitudinally along its upper surface. The end of the perforated pipe which projects past the inlet end of the radiator is connected therewith by a vertical inlet pipe (7) which is smaller than the perforated pipe.



DESIGN OF MONAHAN HUMIDIFIER.

The flow of steam through the perforated pipe from the radiator is controlled by the cut-off valve (10). This arrangement permits the flow of steam to the humidifier to be regulated without interfering with the flow of steam through the radiator. The opposite end of the perforated pipe which projects from the other end of the radiator is provided with a condensation return pipe (12). Steam is prevented from returning from the radiator to the humidifier by the short-length pipe (13), although permitting the water of condensation to pass through. Mr. Monahan, the inventor is engineer for the North Dixon schools, and is planning to dispose of his invention.

Pressure Regulating Valve for Hot Water Heating Systems.

An interesting type of pressure regulating valve for hot water house heating systems has recently been developed by the Scientific Heater Co., Cleveland, O., and is shown in the accompanying illustrations. A cross-section of the valve is shown in Fig. 1, while Fig. 2 shows the valve attached to a system. The bronze spring at the left holds the inlet valve open until the system is filled and the water pressure overcomes the spring pressure, say, for instance, 20 lbs., when the inlet valve closes. If the boiler is now fired up and the water expands to a point where the pressure over-

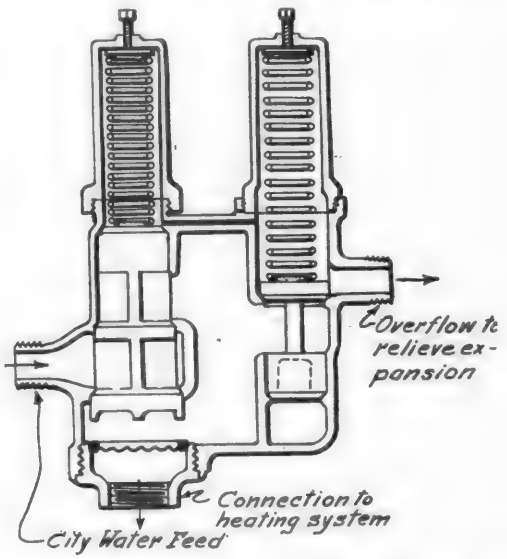


FIG. 1.—CROSS-SECTION OF NEW TYPE OF PRESSURE REGULATING VALVE.

comes the pressure of the spring at the right, say, 30 lbs., this relief valve opens and spill a few tablespoonfuls of water,

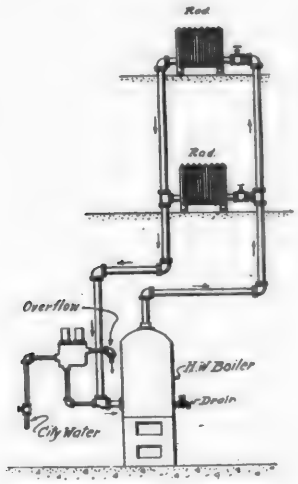


FIG. 2.—HEATING SYSTEM EQUIPPED WITH NEW TYPE OF PRESSURE REGULATING VALVE.

thus relieving the excess pressure.

It will be seen that this valve takes the place of an automatic float-feed expansion tank and line of feed piping to basement, and a pressure generator. The valve itself is constructed so that the seats are self-cleaning, the springs are out of the water and any slight leak goes into the overflow pipe.

New Book.

A MUNICIPAL EXPERIMENT, or the Hall of Records Power Plant (New York) by Reginald Pelham Bolton, has been published by the Bureau of Public Service Economics, Inc. It is a book of 236 pages, including index and presents in detail the results of the well-known tests on this plant to determine whether or not it was more economical to install an independent power plant in the building or to purchase electric current from an outside source. In the original test Mr. Bolton represented the New York Edison Company and the present volume is an elaboration of his conclusions from that test, which favored purchase of current from outside sources as a money-saving proposition. The fact that Mr. Bolton has given up the entire contents of the book to the presentation of his data and conclusions is evidence of his confidence in their accuracy. The subject is discussed from the viewpoints of the taxpayers' investment in machinery, ash disposal by municipal methods, surplus exhaust in coldest weather, and burning cheap fuel. The author has the faculty of presenting his data in a very readable form and the book will well repay the perusal of engineers generally.

New Publications.

EFFECTS OF STORAGE UPON THE PROPERTIES OF COAL, by S. W. Parr, is the title of a bulletin (No. 97) issued by the Engineering Experiment Station of the University of Illinois. The investigation showed, among other things, that bituminous coal can be stocked without appreciable loss of heat values, provided the temperature is not allowed to rise above 180° F. The indicated heat loss per pound of coal is due more largely to an increase in weight of a unit mass of coal resulting from absorption than to an actual deterioration or loss of heat units. Freshly-mined coal has a large capacity for absorbing oxygen which combines chemically with both the organic combustible and the iron pyrites present. The combination of oxygen with coal at ordinary temperatures generates a small increment of heat.

The rapidity with which oxygen is absorbed depends upon the temperature of the mass and the extent of the superficial area exposed, that is, the fineness of division of the coal. If heat is generated by this slow process of oxidation more rapidly than it is lost by radiation, the acceleration of the reaction causes a rise in temperature which quickly brings the mass up to the danger point. A temperature of 180° F. is named as the danger point because, if the coal reaches that temperature, practically all of the free moisture is vaporized and the further rise in temperature will be very rapid.

Any method of storage to be successful must either check or prevent the absorption of oxygen to such an extent that the generation of heat shall not proceed so rapidly as to exceed natural heat losses due to radiation.

Underwater storage prevents loss of heat values, and is not accompanied by deterioration in physical properties, such as slacking.

Dry storage is far more safely undertaken if the fine material is screened out at the storage yard and the lump only, preferably sized, is stocked.

Another report on the deterioration in the heating value of coal during storage, covering a 5-year period, has just been issued by the Bureau of Mines, Department of the Interior, as Bulletin No. 136, the authors beng Horace C. Porter and F. K.

Ovitz. The results are of special interest when taken in connection with those above referred to, made at the University of Illinois. They show that the amount of deterioration of coal in heating value during storage has commonly been overestimated. Except for the sub-bituminous Wyoming coal, no loss was observed in outdoor weathering greater than 1.2% in the first year, or 2.1% in two years. The loss in heating value is given for New River and Pittsburgh coals during five years' storage in the open air and under water, for Pocahontas during two years' storage in the air, and for Sheridan, Wyoming, coal during 2¾ years' storage in the air.

The tests with New River and Pittsburgh coal were made to determine the advantage to be gained by storing coal under water, and particularly under salt water. The results show that storage of New River coal under water effectively prevents deterioration of calorific value and that storage in the air under severe conditions causes only small deterioration, about 1% in one year's exposure and about 2% in two years. After two years the loss is continuous but slow, reaching 2.5% to 3% in five years. The deterioration of Pittsburgh coal during one year's open-air storage was practically negligible. During the second, third, fourth and fifth years the deterioration proceeded very slowly and did not reach an amount greater than 1.1% in five years. The submerged portions suffered no loss measurable by the degree of accuracy of the methods used.

Detailed results and a full account of the tests and analytical data are given in the bulletin, which may be obtained free of charge by addressing the Director of the Bureau of Mines, Washington, D. C.

RULES RELATING TO THE CONSTRUCTION, INSTALLATION, INSPECTION AND MAINTENANCE OF STEAM BOILERS, some of which went into effect July 1, 1917 and others which become effective January 1, 1918, are contained in Bulletin No. 14 on the Industrial Code, issued by the State Industrial Commission of the New York State Department of Labor. The rules take up 117 pages. Under "New Installations," rules are given applying exclusively to boilers used for low-pressure steam and hot water heating and hot water supply. A formula is given for determining the maximum allowable working pressure, this portion of the bulletin occupying thirteen pages. The bulletin is published from the Bureau of Industrial Code, 230 Fifth Avenue, New York.

Trade Literature.

SPRAGUE MOTOR-DRIVEN EXHAUST FAN OUTFITS, direct and alternating current, are featured in a new bulletin No. 41,801, superseding No. 246, issued by the Sprague Electric Works, New York. This company has standardized on Davidson fan outfits in sizes from 18-in. to 48-in. inclusive and Ventura fan outfits in sizes from 10¾-in. to 48-in. inclusive, for both direct and alternating current. Special attention has been paid in the design to have the fans compact, light in weight, yet with ample overload capacity. Care has also been taken to have them well-balanced, as noiseless as possible, and with high efficiency. The motors are totally enclosed. All of the necessary data, with drawings showing dimensions, etc., are included. Size 8 x 10½-in. (standard), punched for binding. Pp. 16.

TEMPERATURE REGULATORS, with special reference to the product of the Taylor Instrument Companies, Rochester, N. Y., are presented in a new catalogue (Section 17,000) which will be found especially useful to the engineer and buyer, because it shows many illustrations of varied applications. It is described as the most complete catalogue covering one specific type of temperature regulator which the Taylor Instrument Companies has published and no effort has been spared to show by numerous illustrations, the wide adaptability of these devices.

STOCO PROTECTION GOGGLES, made by the Standard Optical Co., Geneva, N. Y., are the subject of a catalogue recently issued by this company. It is stated that the Stoco goggle may be worn for long periods without discomfort, injury to the vision or eye fatigue. Because of its broad bearing on the nose and face and its flexible temples, it fits snugly without cutting or chafing the nose or ears. Size of catalogue, 5¼ x 7½ in. Pp. 16.

THE EVERLASTING FUEL SAVERS is the description given of the Metaphram line of regulators manufactured by the National Regulator Co., Chicago, and illustrated and described in newly-issued circular matter. The line includes Types A, Jr., A, BC and D, for low pressure and vapor; Type F for hot water and A-Jacks for high pressure. They are made for boilers of any size, style or duty.

AMERICAN HOT WATER HEATING SYSTEM, (tank-in-basement) is described in newly-issued circular matter received from the American Heating Specialty Co., Peru, Ind. The general arrangement of this system is shown in the accompanying illustration

(Fig. 1) while Fig. 2 shows the construction of the differential pressure relief. This device is designed to relieve the excess pressure when accumulated in the system. Every precaution has been taken in the design and construction to prevent clogging with sediment. The diaphragm acts directly upon the disc and exerts a differential pressure upon this disc at a ratio of 12½ to 1. The opening through the seat is 1⅛ in. It may be adjusted to meet any ordinary conditions by adjusting the screws which rest against the metal cage upon which rests a coil spring. When in operation on a heating system the tension of the spring is slight. The American differential pressure relief is 6 in. outside diameter, 10 in. long and weighs 18 lbs. The company also manufactures the American damper regulator for controlling boiler dampers by means of the pressure of water in the heat-

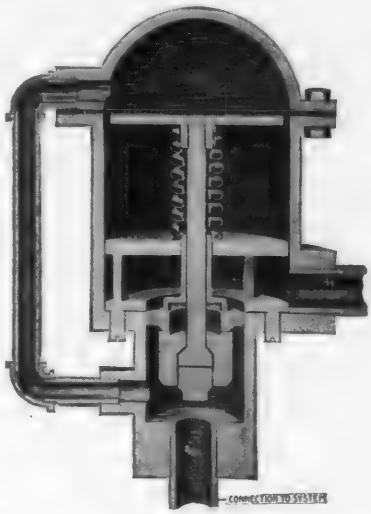


FIG. 2.—AMERICAN DIFFERENTIAL PRESSURE RELIEF.

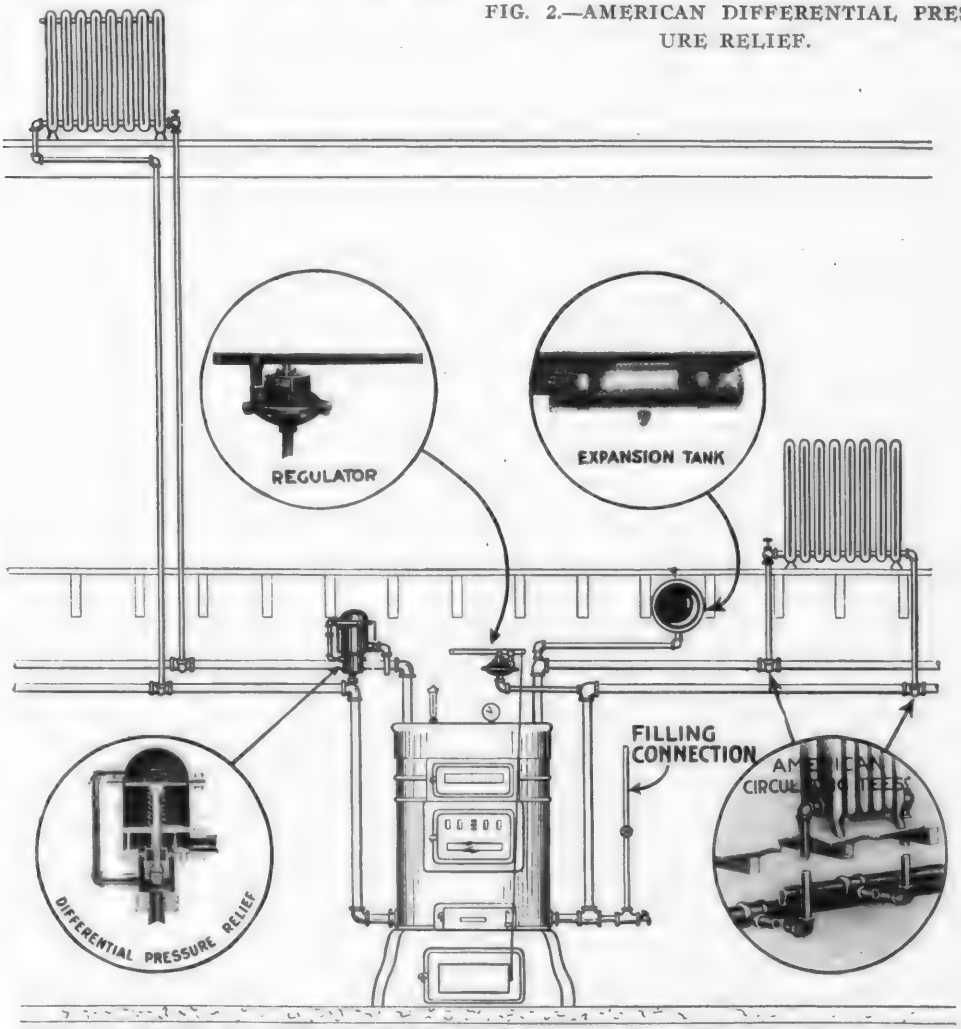


FIG. 1.—AMERICAN HOT WATER HEATING SYSTEM (TANK-IN-BASEMENT METHOD).

ing system. The diaphragm is made of rubber, with canvas insert.

DR. HILL DUST COUNTER is brought to the attention of the trade in circular matter recently issued by the Braemer Air Conditioning Corporation, Philadelphia, Pa. Accompanying the circular is a reprint of Dr. Hill's article on "Quantitative Determination of Air Dust" which appeared in THE HEATING AND VENTILATING MAGAZINE for June, 1917. The Dr. Hill dust counter has been used by the Chicago Ventilating Division and by the Chicago Commission on Ventilation during the past two years. The patent and manufacturing rights have recently been purchased by the Braemer Air Conditioning Corporation. The apparatus is now on sale at $100.00 list, from which a 40% discount is being allowed at the present time. This company is also sending out a leaflet regarding the U. S. S. Recruit, the land battleship recruiting station in Union Square, New York, which is equipped with a Webster air washer installed by this firm. This apparatus was installed in record time, being delivered within two weeks. The equipment weighs 5,000 lbs. The apparatus was loaned for this purpose by the company and is the same equipment used in the company's laboratory for tests and investigations. A fac simile letter from the Navy Recruitng Station is reproduced expressing the satisfaction of the officers on board with the washer and adding that they found it "unquestionably the most valuable single piece of equipment on board, giving splendid service and at all times keeping the ship supplied with a fresh, clean and pure current of air."

HERR'S HUMIDIFIER, applicable to all indirect heating systems, including hot air, indirect steam and hot water, is the subject of a circular issued by J. W. McAfee, sole selling agent, 645 West 171st St., New York. This humidifier generates humdity by converting cold water into the atmospheric aqueous vapor by mechanically breaking the water into particles or droplets so fine that the heat at the ordinary temperature of a room, entering these particles of water, breaks them up by expansion into the natural gas or atmospheric vapor.

It is stated that the device will raise the humidity from 16% or 18% to from 50% to 60%, with the air temperature at 68° to 70° F. The nozzle is made from a special bronze, consisting of a valve plug, with a large and small opening to adjust the stream, a set screw for adjustment, a spoon for breaking the small stream of water into a mist and a drip cup for catching the drip. The catalogue includes detail views, one showing the humidifier attached to an indirect radiator. The device will operate with a water pressure from 12 lbs. to 150 lbs. It is listed at $25.00.

COLUMBIAN REGISTERS, made by the Columbian Hardware Co., Cleveland, O. are the subject of a comprehensive catalogue (No. 1761) detailing the extensive line made by this company. Included in the company's line are three styles of wall registers, three styles of floor registers and the following specialties: ceiling register and ventilator, base board return air faces, Apex gratings for pipeless furnaces, cast convex base board ventilating plates, Columbian cold-air faces, round registers, wood faces and wall frames. Complete price lists are given for each style. Size 8½ x 11 in. (standard). Pp. 32.

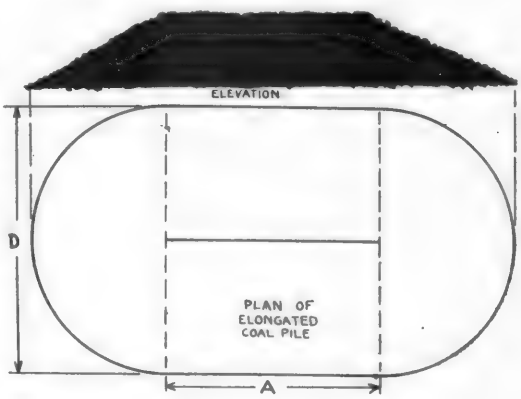
Tons of Coal in Elongated Piles.

By W. F. Schaphorst.

When bituminous coal is piled in a conical pile the tonnage in the volume is easily estimated from the formula, 0.00248 D^3, where D is the diameter of the pile in feet at its base. But coal is often stored in elongated piles, as shown in the accompanying sketch, in which case the tonnage, of bituminous coal, is computed from the formula:

$$0.00248\ D^3 + 0.00474\ AD^2 = \text{tons (bituminous)}.$$

where A is the length of the "crest" on the pile in feet. The best way to determine the



SKETCH OF ELONGATED COAL PILE.

length of this crest is to subtract D from the total length of the pile at its base.

The sketch shows one of these piles both in elevation and in plan. The plan shows clearly how the pile can be cut up into three parts. The two curved end portions, when added together, give us a pure and simple cone, whence we have the $0.00248\ D^3$ in the formula. The central portion has a triangular section from end to end and its volume is one-half as great as would be the volume of a rectangular block having the same base and height. The tonnage in this central triangular portion is $0.00474\ AD^2$. Adding the two together we therefore have $0.00248\ D^3 + 0.00474\ AD^2$.

Where the coal is anthracite instead of bituminous the formula becomes

$$0.00172\ D^3 + 0.0033\ AD^2 = \text{tons anthracite.}$$

D and A are both measured in feet.

These formulas are based on the fact that one ton of coal occupies 38 cu. ft. on the average, whether anthracite or bituminous. The natural cone of anthracite is 0.25 as high as it is in diameter at its base. For bituminous coal the value is 0.36.

Establishment of New Industries To Be Limited During the War.

The Council of National Defense has recommended that no new industrial enterprise should be undertaken at this time which will not help win the war. "In the course of time," says Mr. Waddill Catchings, speaking as chairman of a subcommittee of the council, representing the Chamber of Commerce of the United States, "no one need be surprised if during the war the use of labor and materials for all unessential purposes is made impossible by regulation or statute."

Following is the recommendation in full as made by the Council of National Defense:

"Every effort that this country is capable of making should be applied to bring the war to a speedy and successful conclusion. The resources of the country in a general way may be said to consist of men, money and material, and during the period of the war any new enterprise or undertaking should be tried and justified by the test: Will the men, money and material so applied best contribute in this way to the winning of the war?

"New enterprises which are not fundamental to the efficient operation of the country's necessary activities should not be undertaken. This will not result adversely upon business or conditions of employment because every man and every resource will be needed during the war. All effort should be centered to help win the war."

Call for Technical Troops for France.

"Handy Men" between the ages of 18 and 40 are being called for by the United States Corps of Engineers and by the Aviation Section, Signal Corps. For the Engineers' Corps not only skilled engineers are wanted, but also helpers and workers, clerks, watchmen, etc., in such occupations as water supply companies, pioneer companies, surveying and mapping, railway construction, railway operating, supply and shop work, road building, construction, mining and quarrying. For the aviation section many aero battalions are being organized to comprise both skilled mechanics and helpers, clerks, watchmen, etc., in a wide variety of occupations, including draftsmen, electricians, engine repair men, engine testers, plumbers, stenographers and tool makers. Recruiting stations for both of these services are established at 266 Market St., Newark, N. J., and at the following cities in New Jersey: Paterson, New Brunswick, Camden, Atlantc City, Passaic, Elizabeth, Trenton and Perth Amboy. Major J. E. Bloom, U. S. A. Retired, is in charge.

Deaths

Sam S. Glauber, president and treasurer of S. S. Glauber, Inc., New York, jobbers of heating and plumbing supplies, died suddenly in Denver, Colo., September 15. He was 42 years old. Mr. Glauber had long been in ill health. He had been connected with the Eastern supply trade since 1895.

Andrew C. Mercer, designer of the Mercer heating boiler, died at his home in Brooklyn, September 30. He was 81 years old. Mr. Mercer was a contemporary of the pioneers of the heating profession in this country. He was for many years manager of the New York office of the H. B. Smith Co., of Westfield, Mass. This firm placed the Mercer boiler on the market and has continued to manufacture it up to the present time. Mr. Mercer is survived by one son.

Standard Heating and Ventilating Data Sheets.

Previously-published data sheets, similar to those appearing in this issue, are as follows:

FEBRUARY, 1917, ISSUE.

No. 1—B.T.U. Losses.
No. 1-A—B.T.U. Losses—Brick.
No. 1-B—B.T.U. Losses—Stone and Concrete.
No. 1-C—B.T.U. Losses—Combinations

MARCH, 1917, ISSUE.

No. 1-D—B.T.U. Losses—Tile.
No. 1-E—B.T.U. Losses—Frame Construction.
No. 1-F—B.T.U. Losses—Glass, Skylight and Miscellaneous.
No. 1-G—B.T.U. Losses—Ceiling, Floor and Roof.

APRIL, 1917, ISSUE.

No. 2—Exposure.
No. 3—Leakage.
No. 4—Temperature Range.
No. 4-A—Temperature Range.

MAY, 1917, ISSUE.

No. 5—Computing Heat Losses.
No. 6—B.T.U. Example of Computation.
No. 7—Ventilation.
No. 8—Air Changes—Churches and Theatres.

JUNE, 1917, ISSUE.

No. 8-A—Air Changes—Hospitals.
No. 8-B—Air Changes—Hotels and Libraries.
No. 8-C—Air Changes—Schools.
No. 8-D—Air Change—Miscellaneous.

JULY, 1917, ISSUE.

No. 9—Properties of Air.
No. 10—Ducts and Flues.
No. 10-A—Elbows.
No. 10-B—Anemometer Readings.

AUGUST, 1917, ISSUE.

No. 10-C—Underwriters' Rules.
No. 10-D—Underwriters' Rules (Continued).
No. 10-E—Underwriters' Rules (Continued).
No. 10-F—Duct and Flue Velocities.

SEPTEMBER, 1917, ISSUE.

No. 10-G—Vent Flue Velocities.
No. 10-H—Areas of Pipes.
No. 10-I—Areas of Pipes (Continued).
No. 10-J—Pipe Capacities at Various Velocities.

OCTOBER, 1917, ISSUE.

No. 100—Chimneys.
No. 100-A—Chimneys—Residence.
No. 100-B—Chimneys—Residence (Continued).
No. 100-C—Chimneys—Coal and Air per B.H.P.

Errata.

Sheet No. 8-A, in the June issue on "Air Changes—Hotels and Libraries," should be No. 8-B.

Sheets Nos. 10-J and 10-K on "Area of Pipes," should be Nos. 10-H and 10-I.

In Sheet No. 9, on "Properties of Air," an error appears in the last column heading which should read, "Cubic Feet of Air Raised 1° F. by 1 B.T.U."

All of these errors have been corrected on the reprinted loose sheets.

Copies of the Standard Heating and Ventilating Data Sheets, printed separately on one side only, may be obtained at 5 cents each. Special binders are furnished by the Heating and Ventilating Magazine Company for holding the sheets, the price of the binders being $1.00 postpaid. They are bound in brown duck, with strong spring clasp.

Special attention is called to the fact that the sheets will not always appear in these columns consecutively numbered.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at Cooperstown, N. Y., for October 1, 1917.

County of New York, } ss.
State of New York, }

Before me, a notary in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn, according to law, deposes and says that he is the Editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912 embodied in Section 443 Postal Laws and Regulations printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.
Editor, A.S. Armagnac, 1123 Broadwy, New York.
Managing Editor, None.
Business Manager, Gustave Petersen, 1123 Broadway, New York.

2. That the owners are: (Give names and addresses of individual owners, or if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
Heating and Ventilating Magazine Co., 1123 Broadway, New York.
A. S. Armagnac, 1123 Broadway, New York.
Gustave Petersen, 1123 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 27th day of September, 1917.
A. L. Scantlebury, No. 239,
Notary Public, Kings County,
Certificate filed in New York County.
(My commission expires March 30, 1919.)

Chimneys

The next factor consists of determining the draft loss through the fire, this loss varying according to the number of pounds of coal burned per square foot of grate and the quality of coal used.

Tests show that under average conditions the loss of draft through the fire runs about as follows:

DRAFT LOSS IN FIRE.

(In. of water)

FUEL	POUNDS OF COAL PER SQUARE FOOT PER HOUR BURNED ON GRATES 5	10	15	20	25	30	35	40	45
Anthracite									
No. 3 Buck	0.15	0.40	0.75	1.24	..	..	..	..	..
No. 1 Buck	0.10	0.24	0.44	0.68	1.00	..	..	..	..
Pea	0.06	0.16	0.30	0.45	0.65	0.90	1.20	..	..
Bituminous									
Semi bituminous	0.05	0.10	0.18	0.26	0.35	0.45	0.58	0.70	0.78
Penn. Ala. Ill. & Ind.	0.04	0.09	0.15	0.22	0.28	0.38	0.45	0.55	0.60
Slack	0.04	0.07	0.10	0.15	0.20	0.27	0.34	0.40	0.50
Run of Mine	0.04	0.05	0.08	0.10	0.14	0.16	0.20	0.25	0.32
On Chain Grate	0.05	0.12	0.15	0.23	0.31	0.44	0.57	0.75	0.94

For ordinary installations the burning of 5 lbs. of coal per horsepower is usually assumed. The maximum number of pounds of coal which a boiler must consume divided by the grate area in square feet will give the number of pounds of coal burned per square foot of grate.

The draft losses in boilers run about as follows:

Type of Boiler.	Per cent of Nominal Rating Developed 100	150	200
	Loss in Inches of Water		
Water Tube	0.25	0.40	0.70
H. R. T.	0.20	0.30	0.45
Vertical	0.10	0.15	0.20

As heating boilers are seldom run at any overload, 0.25 or 0.30 may be taken as covering the draft loss in any such boiler.

Economizers add 0.30 in. to the draft loss.

Draft losses for bends and smoke breeching are:

Steel Flues per 100 ft. run, 0.10 in.; for each 90° bend, 0.05 in.

Concrete per 100 ft. run, 0.20 in.; for each 90° bend, 0.10 in.

Note.—Include every bend from the boiler uptake to the stack, counting the turn upward in the stack as one bend.

Chimneys

The draft loss in the stack should run about 0.20 in. per 100 ft. of height in order to get economical construction.

The "effective" draft is the theoretical draft produced by the stack, with gases at a given temperature, less the loss produced by friction. The theoretical draft is shown by the curves in Sheet No. 100-F.

Air at higher elevation than sea level expands and requires a chimney of larger area to handle the same number of pounds at the same velocity and friction loss. The table below gives the percentage of increase for various heights up to 10,000 ft. above sea level.

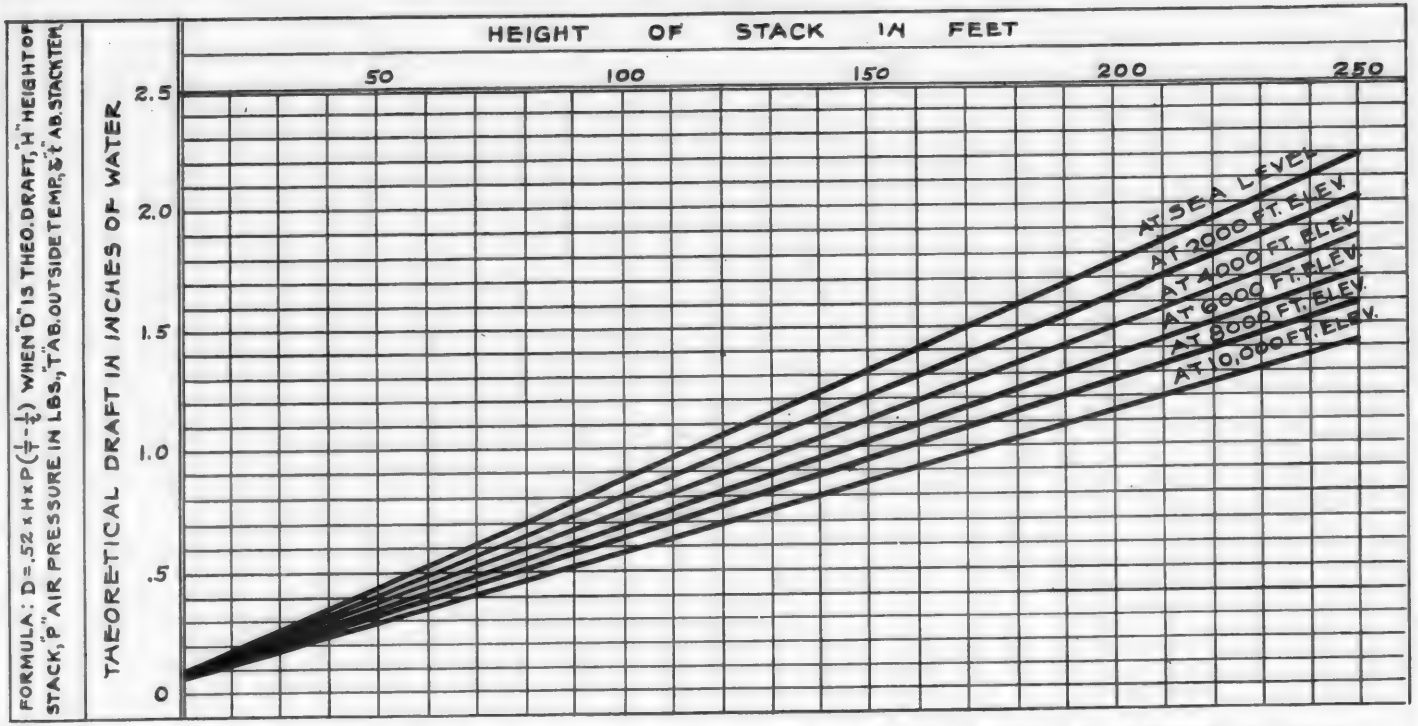
FACTORS OF AIR AT VARIOUS ELEVATIONS.

Elevations Above Sea Level Feet	Air Pressure Per Sq. in. in Pounds	Cubic Feet Per Lb.	Increase In Volume %
0	14.7	13.33	0.000
1,000	14.2	13.80	0.034
2,000	13.7	14.31	0.073
3,000	13.2	14.84	0.113
4,000	12.7	15.43	0.158
5,000	12.2	16.07	0.203
6,000	11.7	16.75	0.257
8,000	10.7	18.31	0.373
10,000	9.7	20.20	0.514

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY—N.Y.CITY.

THEORETICAL DRAFT OF STACKS

WITH OUTSIDE TEMP ZERO, STACK TEMP. 500°F

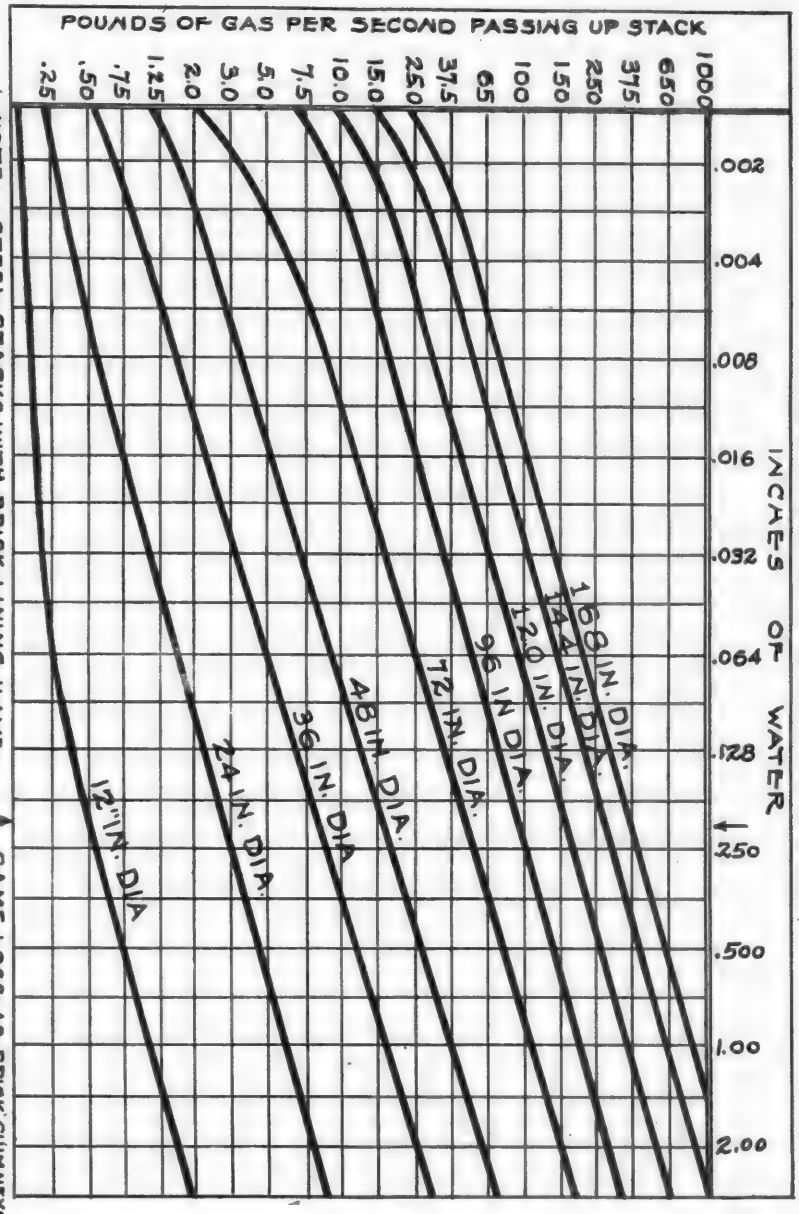


FORMULA: $D = .52 \times H \times P\left(\frac{1}{T} - \frac{1}{t}\right)$ WHEN "D" IS THEO. DRAFT, "H" HEIGHT OF STACK, "P" AIR PRESSURE IN LBS., "T" AB. OUTSIDE TEMP., & "t" AB. STACK TEM.

NOTE. THEORETICAL DRAFT NEGLECTS ALL FRICTION AND MUST EQUAL OR EXCEED ALL DRAFT LOSSES BY FRICTION INCLUDING LOSSES IN STACK ITSELF, BOILER BREECHING, ELBOWS, BOILER FLUES, FIRE BED AND GRATES AND ECONOMIZER (IF USED).

No. 100-F

CHIMNEY-THEORETICAL DRAFT OF STACKS



FRICTION LOSS IN STEEL STACKS

IN INCHES OF WATER PER 100 FT. OF HEIGHT

FOR ANY OTHER HEIGHT(H) OF STACK MULTIPLY TABLE LOSS BY $\frac{H}{100}$

FORMULA: $CF = G^2 \times .0014 \times H \times C \div A^3$ WHEN "CF" IS CHIMNEY FRICTION IN INCHES OF WATER, "G" THE WEIGHT OF GAS PER SECOND, "H" THE HEIGHT OF STACK, "C" CIRCUMFERENCE & "A" AREA ALL IN FEET AND .0014 A CONSTANT FOR STEEL STACKS & GASES AT 500° F.

CHIMNEYS—FRICTION LOSSES IN STEEL STACKS | No. 100-G

Heating and ventilating large buildings

Large banks of VENTO Heaters supplying warmed fresh air in a Kansas City school building. Shows the great range of sizes possible with VENTO Heaters

All buildings, such as factories, schools, universites, colleges, churches, stores, banks, hospitals, hotels, theatres, libraries, and museums requiring large volumes of air freshly warmed by steam, vapor or water are efficiently served by

VENTO Heaters

Send for our complete manual of engineering information containing tables of data on temperatures, condensations, ratings, free areas with charts on best methods of connection, etc.

Engineers and heating contractors should use this book for its valuable information.

AMERICAN RADIATOR COMPANY

Sales branches and showrooms in all the large cities

None but the Best of Materials

are used in the construction of the

ALBERGER MULTI-HEAD Water Heater

The shell, tube heads, water channel, and the steam and water heads, are all made in our foundry of a special grade of cast-iron, selected for this purpose, steel and even charcoal iron are not used on account of corrosion. Tubes are of pure copper to stand up under temperature changes.

Send for our manual on "Heating Water with Steam"

ALBERGER HEATER CO.

Buffalo, N. Y.

WESTERN OFFICE:
Peoples Gas Building, Chicago
Agents in all principal cities

ADVERTISERS' INDEX

Advance Pump & Compressor Co..... 82
Alberger Pump & Condenser Co..... 10
Alberger Heater Co..... 70
American District Steam Co.....4 and 87
American Blower Co..... 81
American Radiator Co..... 69
Anderson, A. H..... 88
Badger & Sons Co., E. B..... 4
Bayley Mfg. Co..... 9
Bicalky Fan Co..... 12
Braemer Air Conditioning Corporation.. 78
Bristol Co., The.....Front Cover
Buffalo Steam Pump Co..... 82
Carrier Engineering Corporation..... 84
Cast Iron Pipe Publicity Bureau, Third Cover
Cenral Station Steam Co..... 86
Clarage Fan Co.....Second Cover
Connersville Blower Co..... 3
Davis Regulator Co., G. M..... 90
Detroit Lubricator Co..... 75
Dole Valve Co.....Front Cover
Dunham Co., C. A..... 12
Economy Pump Machinery Co..... 88
Farnsworth Co..... 84
Foster Engineering Co..... 89
Gurney Heater Mfg. Co.....Front Cover
Hornung, J. C..... 89
Howard & Morse..... 71
Ilg Electric Ventilating Co..... 76
Jenkins Bros..... 73
Johns-Manville Co., H. W..... 83
Johnson Service Co..... 8
Kewanee Boiler Co.....Fourth Cover
Knowles Mushroom Ventilator Co., Front Cover
Lavigne Mfg. Co..... 80
Marsh Co., Jas. P..... 3
Mason Regulator Co.....Front Cover
McAlear Mfg. Co..... 10
Moline Heat..... 83
National Air Cell Covering Co..... 88
National Tube Co..... 5
Ohio Blower Co..... 84
Patterson-Kelley Co..... 7
Pearce & Co., W. H..... 7
Powers Regulator Co..... 72
Ric-Wil Co..... 86
Ross Valve Mfg. Co.....Front Cover
Sarco Company, Inc..... 85
Schaeffer & Budenberg Mfg. Co..... 85
Sims Co., The..... 90
Sprague Electric Works..... 9
Standard Thermometer Co..... 73
Standard Wood Pipe Co..... 86
Sturtevant Co., B. F..... 77 and 79
Taylor Instrument Companies..... 8
Underground Specialties Co..... 88
United Vacuum Appliance Co..... 85
Webster & Co., Warren..... 74
Westinghouse Electric & Mfg. Co..... 6
Wyckoff & Son Co., A..... 88

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

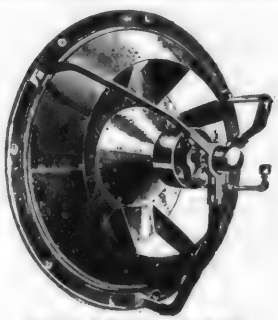
New Haven, Conn.—A gift of $500,000 from Mrs. Stephen Harkness was announced at the October meeting of the Yale University Corporation. The gift will be used for a new heating system.

Detroit, Mich.—Following an announcement by the board of health that a marked increase had been noted in the number of cases of scarlet fever and diphtheria since the opening of the public schools, Dr. Andrew P. Biddle, and Mrs. Laura F. Osborn, inspectors of the board of education, have renewed the agitation for changing the ventilating methods in the older school buildings which now include vent flues discharging through the cloak rooms. It is stated that about 50% of Detroit's public school buildings have this arrangement. Estimates on the cost of changing the systems amount to $90.00 per classroom. The Alger and Doty Schools have been singled out as being in special need of remodeled ventilating systems. W. F. Walker, chief sanitary engineer of the board of education, and Everett Judson, have been detailed to make a survey of the ventilating systems of the city schools.

Clinton, Ia.—After the new passenger station is built in Clinton, it is planned to install a separate heating plant to supply the Northwestern station and all of the office buildings in the yards. In the meantime a temporary heating plant has been installed in one of the buildings adjoining the freight house.

B. F. Bowman, Greencastle, Ind., who was foreman for an Indianapolis heating and plumbing contracting firm, has been appointed chief engineer for the DePauw University heating plant and ventilating and plumbing systems.

Charles City, Ia.—The State University has recently completed a survey of the public schools of Wapello, under direction



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS

which are installed by us complete with **Motors, Duct Work** and **Wiring.**

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

of the College of Medicine, with reference to ventilation and lighting in school rooms. Among the recommendations based on the survey are the following: All rooms not equipped with a special ventilating system should be provided with easily-read thermometers; teachers should be required to read and record the thermometer readings at 10 and 11 a. m. and at 2 and 3 p. m. whenever artificial heat is employed. When the observed temperature exceeds 70° F., the upper window sash should be raised until the temperature drops to 65° F. At the middle of the forenoon and afternoon, when artificial heat is employed, all windows should be opened for five minutes, studies suspended, and the pupils given setting up exercises. For adequate ventilation there should be not less than 20 sq. ft. of floor space per pupil and 250 cu. ft. of space.

Seattle, Wash.—The Seattle School Board, after a prolonged controversy with contracting firms over the installation of the heating system for the new unit of the Whitworth School, has decided to do the work itself. The supplies will be purchased on bids already accepted and the materials installed by day labor. The school board estimated that the labor for installing the heating plant would not cost more than $1,300 and, on this basis, the bids tendered by contracting firms, seemed to show a profit in exces of $5,000. The board demanded lower figures but, after several conferences, it was decided that the school board would do the work.

Sixth National Conference on Housing in America, which was held in Chicago, October 15-17, was addressed by Dr. E. Vernon Hill, of the ventilating division of the Chicago Health Department on "The Modern Science of Ventilation as applied to Dwellings." Lawson Purdy, president of the Board of Taxes and Assessments, of New York City, spoke on "The Zoning of Cities."

Eastern Supply Association has appointed the following from its membership on the reorganized national committee of the Confederated Supply Association in accordance with action taken at the association's summer meeting: D. W. Cook, W. V. Egbert & Co., Newark, N. J.; Jos. F. Evans, Wyoming Valley Supply & Mfg. Co., Wilkes-Barre, Pa.; D. L. Hamill, D. L. Hamill Co., Buffalo, N. Y.; James A. Messer, John Mitchel, Jr., Co., Inc., Washington, D. C.; and H. W. Thorndike, F. W. Webb, Mfg. Co., Boston, Mass.

For Drying Operations

In drying fruits and vegetables temperature conditions *must* be correct, or results are disastrous.

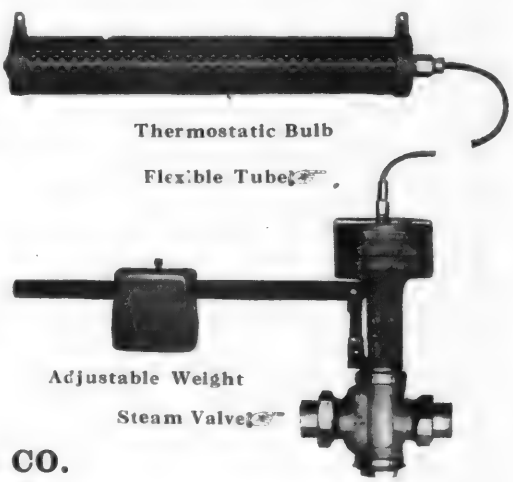
Manual control is neither accurate, reliable, nor economical.

The Powers Automatic Regulator No. 15 holds temperature *exactly* where wanted, is on the job *every minute*, reduces operating costs and increases profits.

This Regulator is used in lumber driers, varnish rooms, enameling ovens, fruit and vegetable dehydrators, sausage driers and other processes where air or vapor temperature must be accurately regulated.

Ask for Bulletin 138 for more detailed information

This Regulator is only one of the extensive Powers line. Put your temperature regulation problems up to us.



POWERS REGULATOR No. 15

THE POWERS REGULATOR CO.

Specialists in Automatic Heat Control

954 Architects Building, New York
2143 Mallers Building, Chicago
365 The Federal Street Bldg., Boston

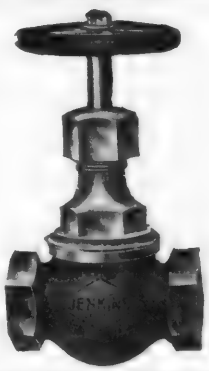
Canadian Powers Regulator Co., Ltd., Toronto, Ont.

Eastern Supply Association held its Fall meeting at the Hotel Astor, New York, October 10.

The following officers were elected: President, Guilford R. Adams, Samuel Sloan & Co., Rochester, N. Y. (re-elected); first vice-president, Jos. F. Evans, Wyoming Valley Supply & Mfg. Co., Wilkes-Barre, Pa.; second vice-president, Captain A. M. Maddock, Thos. Maddock's Sons Co., Trenton, N. J.; treasurer, Martin Behrer, Behrer & Co., New York,; secretary, Frank S. Hanley, 261 Broadway, New York. Board of directors: Guilford R. Adams, Joseph E. Evans, A. M. Maddock, Martin Behrer, W. L. Blake, James F. Conran, James P. McPhail, John A. Murray, F. T. Stevens, O. G. Hitchcock, and A. A. Tomlinson. National Committee representatives: DeWitt Cook, Joseph F. Evans, D. L. Hamill, James A. Messer, and H. W. Thorndike. National Councilor, Chamber of Commerce of the United States, L. O. Koven; substitute national councilor, James A. Messer. Among the firms elected to membership were the Kennedy Valve & Mfg. Co., Elmira, N. Y.; Jenkins Bros., New York. Waddill Catchings, chairman of the Committee on Co-Operation with the Council of National Defense, spoke on the problems now confronting the government and urged the formation of war service committees in all branches of industry. Other speakers were Dr. Talcott Williams who delivered an address on "Autocracy and Democracy," and F. D. Van Amburgh.

In a discussion of market conditions the speakers included Captain A. M. Maddock, P. M. Beecher, of the Richmond Radiator Co.; H. T. Cole, of the United States Radiator Corporation, L. O. Koven and Victor Mauck. The general opinion was that the present level of prices for boilers and radiators was likely to be maintained, due as much to the higher labor costs as to the higher prices of raw materials.

Building Permits for September for 115 principal American cities, as compiled by the *American Contractor*, Chicago, totaled $51,751,484, as compared with $70,980,161, for September, 1916, a decrease of 27%. These figures, however, do not include the enormous government orders for a variety of building materials. Among the cities reporting gains were: Bridgeport 12%, Cleveland 22%, Denver 76%, Fort Wayne 57%, Hartford 94%, New Haven 746% (made up largely of buildings for Yale University), Passaic 153%, Rochester 38%, and Salt Lake City 130%. The important losses were as follows: Akron 38%, Boston 46%, Buffalo 17%, Chicago 49%, Detroit 53%, Philadelphia 32%, San Francisco 10%, and St. Louis 52%. New York City showed little change, the comparatively small figures of September, 1916, amounting to $7,602,999, being increased to $8,276,379, for September of this year.



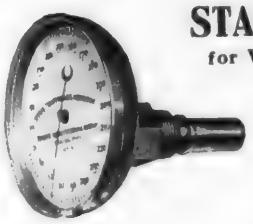
Jenkins Bros. Valves

are always sold under a guarantee of service and satisfaction. It is less expensive to maintain valves bearing for identification the Diamond Trade Mark, with interchangeable parts throughout, than to have the trouble and expense of replacing valves which have no provision for repairs.

There's a Jenkins Bros. Valve for every purpose. Include them in your specifications.

Jenkins Bros.

New York Boston Philadelphia Chicago Montreal London



STANDARD THERMOMETERS - Indicating and Recording

for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers. All Accurate, Durable and Legible.

Backed by thirty years of Thermometer manufacturing.

They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

Ask for catalog No. 100-107 and trade prices

STANDARD THERMOMETER COMPANY, 65 Shirley St., Boston, Mass

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Central Supply Association held its 34th annual meeting at the Auditorium Hotel, Chicago. The Leader Iron Works, Decatur and Chicago, and the Walworth Mfg. Co., Kewanee and Chicago, were elected to membership. One of the principal subjects for discussion was "Standardization of Plumbing and Heating Materials." Referenda No. 21 and 22 of the Chamber of Commerce of the United States, relating to railroad organization and prices during the war received unanimous endorsement. The association went on record as heartily endorsing the principle of "war service committees" in co-operation with the Council of National Defense. H. Walter Heegstra delivered an address on "Organization Salesmanship." New officers were elected as follows: President, J. R. Steneck, Illinois Malleable Iron Co., Chicago; first vice-president, C. V. Kellogg, Kellogg-Mackay Co., Chicago; second vice-president, A. Y. McDonald, A. Y. McDonald Mfg. Co., Dubuque, Ia.; treasurer, Edward F. Niedecken, Hoffman & Billings Mfg. Co., Milwaukee, Wis.; secretary, Paul Blatchford, 1915 City Hall Building, Chicago. Executive committee: J. R. Steneck, C. V. Kellogg, A. Y. McDonald, E. F. Niedecken, P. J. Frey, J. D. Tschopik, E. I. Leighton, F. D. Keeler and George Laib. Members of the national committee: George H. Gorton, M. J. O'Fallon, A. A. Merkel, John Walker and C. V. Kellogg. Representatives in Chamber of Commerce of United States: Theodore Ahrens and George H. Bailey.

Griggs & Myers, consulting engineers, New York, have been retained by the Wright Wire Co., Worcester and Palmer, Mass., to design and supervise the installation of a modern 13,000-k.w. power station, to be used in connection with the present works of the Wright Wire Company, at Palmer.

Grand Rapids, Mich.—The First Annual Grand Rapids National Better Homes Show will be held in Grand Rapids from November 28 to December 8, 1917, under the auspices of a number of Grand Rapids commercial bodies. The exposition will be presented in the interests of the manufacturer, retail dealer, purchaser and consumer of everything that goes into the construction and furnishing of the home. It will be held in the Great Klingman Exhibition Building.

You Need Have no Fear of Heating Troubles This Winter, if You Install The WEBSTER System *NOW*

The WEBSTER System is a method of circulating exhaust steam, live steam, or a combination of the two, to obtain not only the utmost efficiency, but the greatest economy.

Wasting exhaust steam, which might be put to profitable use in heating, is actually throwing money away, since all exhaust steam not so utilized requires additional live steam to be generated, at the expense of fuel and labor, besides the extra wear on the power plant

Webster **Vacuum System of Steam Heating**

has been installed in over 10,000 buildings during the past 29 years. This record has been achieved only by giving uniformly successful results.

The WEBSTER System is adapted to the heating problems of the manufacturer, whether his factory is housed in a single building or in an extended group of buildings.

Old buildings can be "Websterized," very often at comparatively little expense.

The WEBSTER System overcomes "water-hammering," air-binding and excessive coal bills. Circulation of the steam is secured with little or no back pressure upon the engine. Webster Modulation Valves control the temperature in each room or department. Webster Sylphon Traps automatically discharge all air and condensation from radiators and pipe coils.

Let us explain to you how the WEBSTER System will prove efficient and economical.

Write us today. Ask for Catalogue V-37

WARREN WEBSTER & COMPANY

MANUFACTURERS of Webster Systems of Steam Heating, Webster Feed Water Heaters, Webster-Lea Heater-Meters. Webster Steam and Oil Separators, Webster Steam Specialties

MAIN OFFICE AND WORKS **CAMDEN, NEW JERSEY** POINT AND PEARL STS

ESTABLISHED 1888 BRANCH OFFICES IN PRINCIPAL CITIES

See our exhibit at the Second Southern Textile Exposition, Greenville, S. C., December 10-15 inclusive.

DETROIT PACKLESS RADIATOR VALVES

The Correct Valve for the Beautiful Home

Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

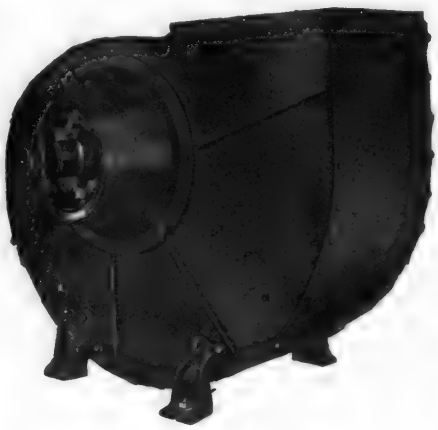
Central Station Heating Notes.

Milwaukee, Wis.—Petitions have been filed with the railroad commission by the Milwaukee Electric Railway and Light Company and the Milwaukee Heat and Traction Company asking an immediate adjustment in electric and heating rates to compensate in part for the increased cost of coal. The companies ask, among other things, that all existing flat rates for steam be discontinued so that all purchase of steam will be made on a meter basis. In addition it is asked that the rates charged for steam on a meter basis be increased.

Sturgeon Bay, Wis.—Consumers of heat in Sturgeon Bay are making no protest to the proposed raise in heating rates asked for by the Sturgeon Bay municipal plant. Superintendent Johnson figures that 30% of the cost of running the municipal plant may properly be charged to the heating end.

Lansing, Mich.—The proposed raise in heating rates by the Michigan Power Company was taken up at a public meeting of the special council and citizens, thus affording an opportunity to the company of discussing every phase of the situation with its customers.

Davenport, Ia.—Construction work on the public service plant of the Peoples' Light



The Vital Spot

in a Blast Heating System is AT THE BLOWER

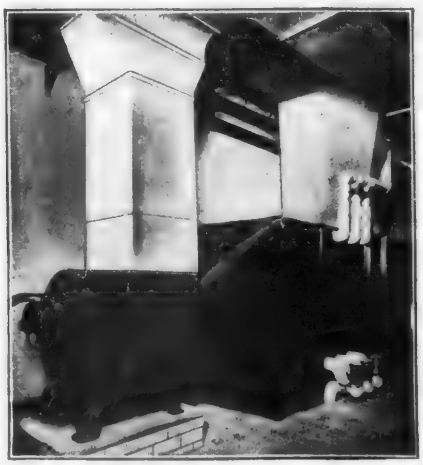
If the Blower is

Ilg Universal

You can be sure that it will be reliable

Motor and Blower

ARE BUILT
BY US and
COVERED BY
ONE GUARANTEE



The one-name plate feature is your protection

ILG ELECTRIC VENTILATING CO.
158 Whiting St., CHICAGO
Branches: All Cities

Handy in the Drafting Room

TO ENGINEERS

For the aid and convenience of Engineers in the preparation of heating and ventilating layouts, we offer our new

Sturtevant
(REG. U. S. PAT. OFF.)

BLUE PRINT BOOK (Bulletin 227B)

provided you write on your letterhead.

Contents include—Heating and Ventilating Layouts for Churches, Educational Buildings, Factories and Industrial Buildings, Foundry and Shop Buildings, Masonic Buildings, Office and Bank Buildings, School Buildings, Theatres—Mushroom Ventilator Detail and Toilet Ventilation.

The drawings will usually suggest ways of making any particular installation. All layouts refer to actual places where the systems were designed to meet the existing condition in each individual case.

The bulletin contains twenty-eight pages, blue prints, standard letterhead size, 8½x11 inches.

B. F. STURTEVANT COMPANY

Dept. B, HYDE PARK, BOSTON, MASSACHUSETTS

Fans Heaters Air Washers Motors Engines

Company was completed October 1, when steam heating service was placed in operation. Hubert C. Blackwell is general manager of the company.

Anderson, Ind.—The petition of the Central Heating Company to increase its heating rates resulted in a hearing before the Indiana Public Service Commission, the company being represented by O. P. Crim, secretary-treasurer, and its attorney C. K. Bagot. It was expected that the commission's decision would be favorable.

Muncie, Ind.—Setting forth that the flat rate charge for steam heating encourages waste and extravagance, the Muncie Electric Light Company has filed a petition with the public service commission at Indianapolis, asking permission to change to the meter system. Most of the customers of the company using city steam heat are now paying a flat rate of 25 cents per square foot of radiation per season. The company desires to have the following meter charges fixed:

First 10,000 lbs. condensation, per month, 60 cents per 1,000 lbs.

Next 40,000 lbs., per month, 50 cents per 1,000 lbs.

Next 50,000 lbs., per month, 40 cents per 1,000 lbs.

All over 100,000 lbs., per month, 35 cents per 1,000 lbs.

These rates are subject to a minimum charge of two cents per square foot of radiation connected for each month of the heating season, except that when an atmospheric or vapor system of radiation is installed the minimum charge will be based upon 1¼ cents per square foot of radiation.

Churches and halls will be subject to a minimum charge of 1½ cents per square foot of radiation per month for the heating season.

The company in its petition says that unless it is granted permission to adopt the meter system, it will discontinue its heating business.

Springfield, O.—Consumers of heat in Springfield are raising strenuous objections to the increase in heating rates made by the Springfield Light, Heat and Power Company, effective October 1. It is claimed that the average increase is about 43%. The company filed its new schedule with the State Public Utilities Commission but the consumers claim that no announcement was made of the increase until a few days before October 1.

Terre Haute, Ind.—In the hearing of the Mutual Heating Company, asking for an increase in its heating rates it was brought out that the increase, according to the plan of the company, would amount to 50%. Among the higher costs it was stated that

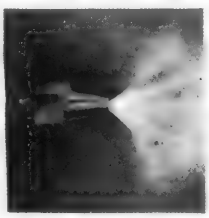
FOOD PRODUCTS

should be produced under ideal atmospheric conditions in order that the product be of the best quality.

Uniformity in results—the reduction in possible variation in quality—the increased efficiency of help, can be largely effected by the installation of a

Braemer Air Conditioning Apparatus

Air Purifying — Humidifying — Low Temperature Drying — Industrial
Air Cooling — Dehumidifying — High Temperature Drying — Ventilation
Dust Removal — Reclamation



Spray Nozzle in Operation

Braemer Air Conditioning Corporation

411 Lafayette Building
PHILADELPHIA, PA.

New York Chicago
Cleveland Cincinnati St. Louis Kansas City
Indianapolis Milwaukee

STURTEVANT VACUUM CLEANERS

One of the salient features of the **Sturtevant** Vacuum Cleaner is the inverted dust bag, held up by the current of dirt laden air entering the machine This bag insures absolute removal of the dirt from the air. It is so large that the resistance to the flow of air is practically negligible; since it is constantly vibrating, dirt cannot cling to it and increase the resistance

Handbook 248V on request

B·F·STURTEVANT Co.
·HYDE·PARK·BOSTON·MASS·
·AND ALL PRINCIPAL CITIES·
Selling Agents Sanford Riley Stoker Co. Ltd.
"THE RILEY STOKER"

STURTEVANT AUTOFORCE VENTILATORS

Utilize wind pressure to induce a positive flow of air from the building. For this reason they exhaust more than three times as much air as the ordinary hooded ventilator and more than twice as much as the ordinary swinging cowl ventilator

Bulletin 232 for engineers on request

Sturtevant

(REG·U·S·PAT·OFF.)

liability insurance, station maintenance and miscellaneous expenses each represented an increase of 20%. The commission was to announce its decision later.

Springfield, O.—An ordinance recommending that the price of heat be fixed for the next five years at the rate now in force has been introduced at a recent meeting of the city commission. The proposed ordinance was presented in conjunction with a letter from City Manager Ashburner recommending the passage of the ordinance. The proposed ordinance is the result of the application of the Springfield Light, Heat & Power Company for a raise in its rates. Under the ordinance as submitted the maximum price which the company may charge is 60 cents per 1,000 lbs. for the first 60,000 lbs. of condensation, 50 cents per 1,000 lbs. for the next 50,000 lbs. and 40 cents per 1,000 lbs. for all over 100,000 lbs., with a minmum charge of $135.00 during the heating season.

Manufacturers' Notes.

Kanawha Mfg. Co., Charleston, W. Va., announces that J. B. Bernhard, manager of the company's boiler department, will have charge hereafter of the Chicago office, located in the Building Material Exhibit building, 175 West Jackson Boulevard.

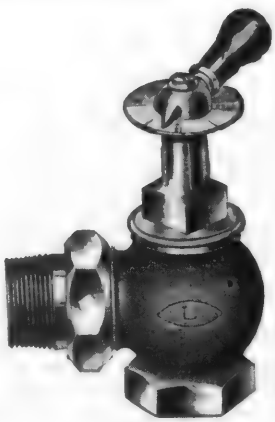
Ahrens & Ott Mfg. Co., Louisville, Ky., which was recently taken over by the Standard Sanitary Mfg. Co., Pittsburgh, Pa., will be operated as the Ahrens & Ott Division of the Pittsburgh company.

Somerville Iron Works, Somerville, N. J., announces that Thomas F. Cushing, who has been connected with this company, has been appointed special sales agent, with headquarters at 735 Drexel Building, Philadelphia. The company manufacturers soil pipe and fittings.

Fierce Club, composed of the selling forces of the Boston and Worcester branches of the Pierce, Butler and Pierce Corporation, held its annual outing at Lake Boon, September 15. There were 50 men in the party who spent the day in carrying out a number of athletic events, including a baseball game between the Boston "Red Sox" and the Worcester "All Stars."

Bound Brook Engine & Mfg. Co., New York, announces the purchase of the plant and business of the American Engine & Electric Company, of Bound Brook, N. J., and will continue the manufacture of the well-known American-Ball engines. Harry J. Marks, who has been identified with the

Going to Sea Unprepared for Storms



is like using a steam valve that leaks.

Compare your steam heating contracts with a ship prepared for a long voyage. If you want your job to "get across," prepare it for the most rigid tests and examinations. To do this you must use the best of everything, including

LAVIGNE

Packless Quick-Opening Steam Radiator Valves

They will anchor your customers in the quarantine of satisfaction and pilot your earnings into the harbor of profit.

See that you get LAVIGNE and no substitutes.

All good jobbers handle them

LAVIGNE MANUFACTURING COMPANY

Detroit, Michigan

Sirocco
TRADE MARK

Will Put Pure Washed Air Into Every Corner of Your Factory

The Dodge Bros. (Motor Cars) Office and Plant are almost exclusively equipped with Sirocco Products.

Their fine office building, here shown, is served by the Sirocco Washed Air System Their Dining Room, Kitchen, Core Shop, Pressed Steel and Gear Shop have the healthful influence of a constant supply of fresh, properly tempered air. These departments, too, are served by Sirocco Apparatus.

Book No. 2709 illustrates many plants in which "Sirocco" Systems are used. May we send it to you?

AMERICAN BLOWER CO.

DETROIT, MICH.

Our Engineering Department will gladly assist in solving your air handling problems

Smith, Hinchman & Grylls, Detroit
Architects and Engineers

sale and installation of American-Ball engines for the past ten years, will continue as district manager of the company in New York.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces another increase in wages for its shop employees aggregating nearly $2,000,000 a year, effective October 16. This will apply to all employees observing shop hours, except munition workers. The increase is in the form of an additional bonus of 10% if on a salary or time-rate basis, and 7% if on a piece, premium or task basis. The company employs 20,000 shop workers and since the beginning of the war, has granted wage increases amounting to 60% more than the former average compensation.

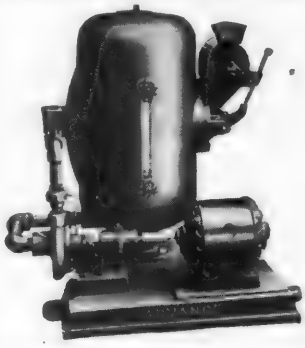
Jenkins Bros., New York, has received the order for furnishing the valves throughout in the new Hotel Commonwealth, which is being built in Times Square, New York, at a cost of $1,500,000.

New Incorporations.

Kinnear & Russell Plumbing & Heating Co., Akron, O., capital $10,000. Incorporators: R. E. Kinnear and others.

Harry L. Hanson Co., Butte, Mont., capital $20,000, to conduct a heating and plumb-

"ADVANCE"
CONDENSATION PUMPS
For Low Pressure and Vapor Heating Systems



Electric Motor Driven, Automatic in Operation

Obtain absolute protection against overloading and burning out of motor, by using "ADVANCE" Condensation Pump and Receiver Equipment.

Write now for Bulletin HV-205

Advance Pump and Compressor Co.
BATTLE CREEK, MICH.

RELIABLE
COMPACT
EFFICIENT

No Steel Tank
to Rust Out

Buffalo Automatic
Condensation Pumps

are used to handle returns to boilers in hundreds of low pressure heating systems, materially reducing fuel consumption.

40 GALLON CAST IRON RECEIVER
BRASS FITTED PUMP

Specify amount of condensation, boiler pressure and details of electric current in your inquiry.

Buffalo Steam Pump Co.
Buffalo, N. Y.

ing and contracting business. Directors: Harry L. Hanson, John S. Wyman and W. L. Parmalee.

Jackson Supply Co., Indianapolis, Ind., capital $10,000, to deal in heating and plumbing supplies. Directors: Jesse O. Jackson, George O. Jackson and Albert E. Cottey.

H. E. Davis Plumbing & Heating Co., Miami, Okla., capital $5,000. Incorporators: H. E. Davis, R. B. Logan and George D. Piper, all of Miami.

Enterprise Heating Co., Atlanta, Ga., capital $10,000. Incorporators: L. J. Brumbelow, L. H. Brumbelow and A. Thomas.

Osborn Plumbing & Heating Co., Columbus, O., capital $2,500. Incorporators: B. C. Osborn, R. F. Earhart, D. S. Earhart and W. H. Whissen.

Satisfaction Heating Co., Los Angeles, Cal., capital $10,000, to conduct a heating contracting business. Incorporators: C. G. Wharton, S. M. Campbell and W. H. Soule.

McNary & Johnson Co., Welch, W. Va., capital $10,000, to conduct a heating and plumbing business. Incorporators: J. F. Johnson, C. S. McNary, E. C. Brally and Paul W. Jones, all of Welch.

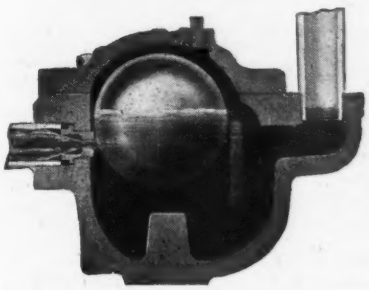
THESE VALUABLE BOOKS *FREE!*

Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely *FREE!*

Moline Heat EVERYWHERE

Moline · Illinois



Johns-Manville Steam Trap

Only three parts—body, bushing and ball

If we told you that a seamless hollow ball would regulate discharge of condensate and air from drip lines without loss of steam, you'd probably be skeptical.

But if we surrounded the ball with a specially designed body and provided an accurately designed outlet, and then proved that weight of ball and size of outlet were exactly calculated against buoyancy and steam pressure, it would sound reasonable. And when you saw a Johns-Manville Steam Trap in action, you'd require no more argument.

Just a body, a discharge bushing and a ball—that's all there is to this simplest and surest of steam traps. When water first flows to it, the ball floats to the orifice and is held there by unbalanced steam pressure. As water accumulates, the ball rises and permits discharge of water, which also draws off air through the outlet vortices. But when the water level falls, the ball rolls down with it and again seals the orifice, preventing loss of steam. This operation is continuous.

If you're having trap trouble—or if you want to learn how to avoid it—send for our special Steam Trap Bulletin.

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

H. W. JOHNS-MANVILLE CO.

New York City

10 Factories—Branches in 55 Large Cities

New Firms and Business Changes.

Drying Systems, Inc., 910 South Michigan Ave., Chicago, has been organized to co-ordinate the engineering and manufacturing facilities of the Wenborne-Karpen Dryer Co., of Chicago, and the Greef Engineering & Mfg. Co., of Newark, N. J. The Wenborne-Karpen Dryer Company, while turning over to the new firm the sales and engineering departments of its business, will retain its own identity. The various patents owned and controlled by this company will be retained for the mutual protection of the company and its customers. The new organization is fully licensed under these patents and those of the Greef Engineering & Mfg. Company. The officers of the new company are: President, F. A. Lippert; vice-president, Charles H. Currier; secretary-treasurer, Adolph Karpen.

WANTED

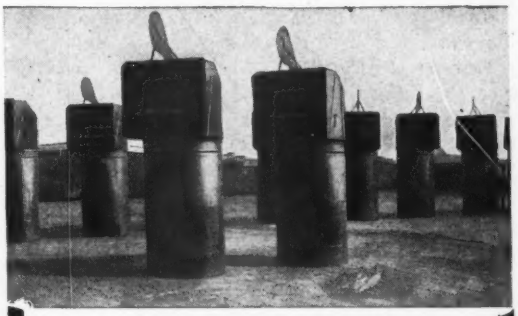
Wanted.—Superintendent steam distribution for district heating system. Address Box L, care of THE HEATING AND VENTILATING MAGAZINE.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until November 14, 1917, for the remodeling of the U. S. Court House at Austin, Texas.

Until November 23, 1917, for the construction of the U. S. Post Office at Woodbury, N. J.



NOT ONE CENT FOR POWER FOR THIS BATTERY OF

SWARTWOUT
ROTARY BALL-BEARING
VENTILATORS

"They put the wind to work" and insure a liberal supply of pure, fresh air in your buildings. There are no friction-inducing bends, angles or "weather rims"—just one 90° angle between the stack and open air.
The cost of installation is low, and the cost for power and upkeep are nothing. The results speak for themselves.

Write for this 24-page book—it's free to you.

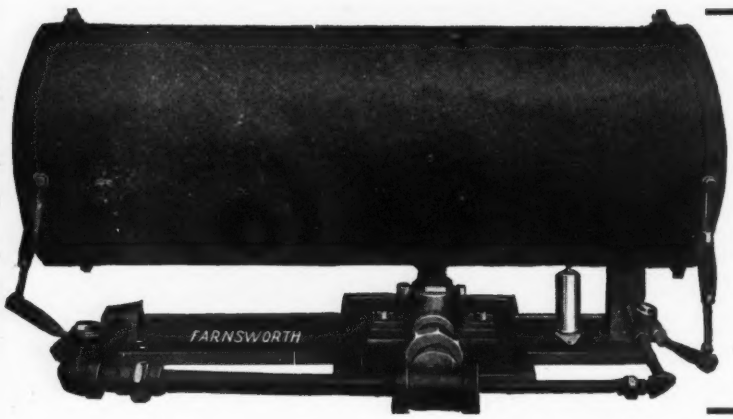
"The Gospel of Fresh Air" tells how some of the most difficult problems have been solved, and shows how yours can be.

The Ohio Blower Co.
9211 Detroit Ave. Cleveland, Oh

Air Conditioning

never involves too complex a problem if you avail yourself of our advice

Carrier
Engineering Corporation
39 Cortlandt St., New York
Boston Philadelphia Buffalo Chicago



Condensation Pumps

7 Types

Send for catalogue and circular showing systems

FARNSWORTH CO.
Conshohocken, Pa.

The Heating and Ventilating Magazine

VOL. XIV. NO. 12

Contents for December, 1917

Calibration of Anemometers ..... *A. H. Anderson* 15

The Heating Equipment for a Great Military Camp 18
Details of the Installation at a Typical Cantonment—Camp Upton, Yaphank, L. I., N. Y.

Chicago Commission on Ventilation 29
Ventilation Test of the Lewis Champlin School, Chicago.

Air Cooling and Refrigeration 41
Air Cooling in a Chewing Gum Plant.

Power Plant Engineering 45
Feed-Water Heating.

The War and the Heating Engineer 50
Call for Service Overseas.
Skilled Workers for the Air Service, U. S. A.
Officers Wanted for Civil Engineer Corps, U. S. Naval Reserve Corps.
Activities of the Shipping Board and Emergency Fleet Corporation.
Thirtieth Engineers, Gas and Flame, Being Organized.
Chamber of Commerce Advocates Further Price Control.
Government Contracts.
On Government Work.
Liberty Loan Subscriptions.
Coal-Saving Hints for Power Plant Owners and Managers.

Correspondence 53
A Steel Stack Problem.
Back Draft in Chimney.

American Society of Heating and Ventilating Engineers 56
Cantonment Heating and Ventilation Discussed by Illinois Chapter.
Kansas City Chapter Urges Fuel Conservation in the Home.
New York Chapter Hears About the Fuel Situation.

The Weather for October, 1917 60
New York, Boston, Pittsburgh, Chicago and St. Louis.

Standard Heating and Ventilating Data Sheets 63
No. 100-H—Chimneys—Friction Losses in Brick Stacks.
No. 100-I—Chimneys—Summary and Draft Reading.
No. 100-J—Chimneys—Example for Figuring Steel Stack.
No. 100-K—Chimneys—Costs.

YEARLY SUBSCRIPTION $1.00 **SINGLE COPIES, 10 CENTS**

Published monthly at Cooperstown, N. Y., by the Heating and Ventilating Magazine Co.

Executive and Editorial Offices, 1123 Broadway, New York

The Acme of Heating Comfort

Heat when you want it—"cooling off" when you want that—a perfectly controlled heat. House kept at any desired temperature during the day; cooled off as many degrees at night as wished. Then, in the morning at four, five, six or any determined hour, temperature raised to normal. Merely set the control as you set an alarm clock. This is the miracle story which you can tell your client if you install

The DUNHAM VAPOR HEATING SYSTEM

THE DUNHAM TRAP does away with all pounding in pipes. Half hot—half cold radiators an impossibility. No hissing, sputtering valves.

THE DUNHAM INLET VALVE installed at top of radiator does away with stooping and all wrist-tiring turning. A single turn and heat is on or off. Many other special Dunham features. Investigate before planning or installing your next residence contract. Write for details.

C. A. Dunham Company

MARSHALLTOWN, IOWA

New York **Chicago** **San Francisco**

CANADIAN FACTORY—TORONTO

Branches in principal cities within the United States and Canada

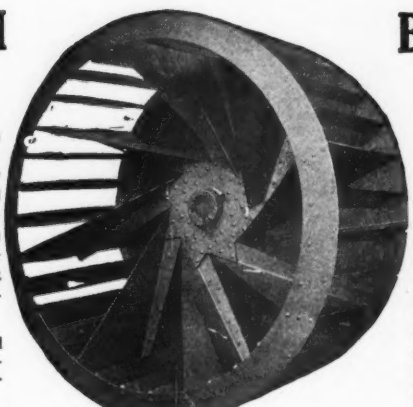
BICALKY

BI-MULTI FANS

are used all over the country and abroad. They are specified by leading engineers and architects. Their design and construction permit operating these fans at the highest pressure without racking.

The efficiency obtained with these fans has upset all previous engineering dope.

We guarantee results. Write for Catalogue.



Single Inlet Wheel

BI-MULTI FAN WHEELS

are built exceptionally strong. They are guaranteed to stand up and do not rack under the heaviest work that fans are subjected to.

This, in connection with their high efficiency, has created the large demand for

BI-MULTI FANS

BICALKY FAN COMPANY

Buffalo, N. Y.

SALES AGENTS

Batterman. Truitt Co., 18-20 East Kinzie St.. Chicago. Ill.
J. S. Chapman & Co., 89 Jarvis St., Toronto. Ont.
Schellhammer & Co., Warren Pa.
H. Carlton Hewitt Co., 455 Hipp Bldg., Cleveland, O.
Chas. W. Carll's Sons, 3-7 West Front St., Trenton N. J.
Sink & Edwards, 519 Massachusetts Ave., Indianapolis, Ind.
Eagle Roofing & Art Metal Works, 203 Cass St., Tampa, Fla.